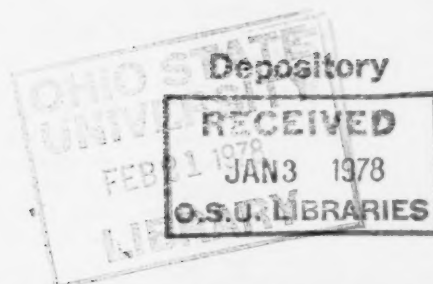


Main



SELECTED **WATER RESOURCES ABSTRACTS**



VOLUME 10, NUMBER 24
DECEMBER 15, 1977

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W77-12251 - W77-13000
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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,
U.S. Department of the Interior



VOLUME 10, NUMBER 24
DECEMBER 15, 1977

W77-12251 -- W77-13000

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department.

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Selectd Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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Includes the following Groups: Properties; Aqueous Solutions and Suspensions

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

EQUATION OF STATE OF PURE WATER AND SEA WATER,

Scripps Institution of Oceanography, San Diego. Marine Physical Lab.
F. H. Fisher, and O. E. Dial, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A017 775, Price codes: A02 in paper copy, A01 in microfiche. Report SIO Reference 75-28, November 1, 1975. 13 p, 6 fig, 7 tab, 21 ref, 2 append. ONR N00014-69-A-0200-6002, NSF DES-70-00094A04.

Descriptors: *Volume, *Salinity, *Physical properties, *Water temperature, *Water pressure, Properties, Pressure, Chemical properties, Sea water, Temperature, Saline water, Equations, Mathematical studies, Water properties.
Identifiers: *Pure water properties, *Sea water properties, *Pure water, Partial molal properties, Tumlirz equation, Usual Tait equation.

For representing the PVT properties of pure water and solutions, seawater in particular, the Tumlirz equation was selected: $V = V_{\text{sub infinity}} - K \text{ sub } 1 S + \text{Lambda}/P \text{ sub } 0 + K \text{ sub } 2 S + P$; where V is the specific volume as a function of pressure P, salinity S and temperature. For pure water S + O and for seawater, V sub infinity, lambda and P sub 0 are the pure water values. For pure water, an analytic function was obtained which fits the data of Kell and Whalley to approximately 8 ppm from 0-100 degrees and approximately 15 ppm from 100-150 degrees up to 1000 bars. The calculated density maximum is at 4.00 degrees. The form of the equation appears to be useful not only for representing the properties of seawater but also for deriving partial molal properties of solutions at low concentrations from high concentration data. (Henley-ISWS)
W77-12570

APPARATUS FOR DETERMINING SALINITY OF FLUIDS,

Office of the Secretary (Navy), Washington, D.C.
H. W. Doddington, and D. M. Sheppard.
U.S. Patent No 4,020,677, 4 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 64, May 3, 1977.

Descriptors: *Patents, *Sampling, *Salinity, *Water properties, Instrumentation, Measurement, Conductivity, Electrical conductance.

A high resolution laboratory device determines salt concentration in water. A probe of electrical insulating material is provided with inner and outer electrodes. The inner electrode is positioned in a cavity and fluid enters this cavity by means of a horizontal slit and a small vertical hole. A sinusoidal current excitation source is connected to the electrodes and the electrical current density between the two electrodes is small except in the vertical hole where the current density becomes very large. The resistance between the electrodes at any instant is governed by the resistance of the fluid in the vertical hole and the resistance of the fluid is measured by determining the peak amplitude of the voltage drop across the vertical hole. A general object of the invention is to provide a high resolution instrument for measuring salinity in fluid. (Sinha-OEIS)
W77-12687

1B. Aqueous Solutions and Suspensions

EQUATION OF STATE OF PURE WATER AND SEA WATER,

Scripps Institution of Oceanography, San Diego. Marine Physical Lab.
For primary bibliographic entry see Field 1A.
W77-12570

2. WATER CYCLE

2A. General

CORRELATIONS BETWEEN RAIN AND RUNOFF AMOUNTS AND COMPOSITION IN EASTERN SOUTH DAKOTA,

South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 4A.
W77-12308

SIMULATION PROCEDURE FOR MODELING TRANSIENT WATER-TABLE AND ARTESIAN STRESS AND RESPONSE,

Geological Survey, Little Rock, Ark. Water Resources Div.; and Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-12391

URBAN RUNOFF CHARACTERISTICS: VOLUME I - ANALYTICAL STUDIES,

Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W77-12477

URBAN RUNOFF CHARACTERISTICS: VOLUME II - FIELD INVESTIGATIONS,

Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W77-12478

AN EMPIRICAL METHOD FOR SIMULATION OF WATER TABLES BY DIGITAL COMPUTERS,

Nevada Univ., Reno. Water Resources Center.
For primary bibliographic entry see Field 2F.
W77-12546

HYDROLOGIC STUDY OF ILLINOIS BEACH STATE PARK,

Illinois State Water Survey, Urbana.
A. P. Visocky.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 146, Price codes: A04 in paper copy, A01 in microfiche. Circular 128, 1977. 48 p, 42 fig, 14 tab, 17 ref, 1 append.

Descriptors: *Watersheds(Basins), *On-site investigations, *Illinois, *Hydrologic aspects, *Lake Michigan, Methodology, Drainage, Groundwater, On-site data collections, Analysis, Water table, Monitoring, Water quality, Alkalinity, Hardness(Water), Natural recharge, Barriers, Drainage systems, Surface waters, Instrumentation, Beaches, Shores, Erosion, Streamflow, Water levels, Evaluation, Aquifers, Pumping, Specific yield, Dissolved solids.
Identifiers: *Illinois Beach State Park(III).

The study area, including Illinois Beach State Park, is a 6.7-square-mile strip of land along Lake Michigan near the Wisconsin border. Roadway

and basement flooding at the park lodge have been a problem in recent years. A hydrologic study to gather groundwater, stream, and Lake Michigan water level data and water samples, as well as precipitation records, from January 1975 to April 1976 was undertaken. The data were presented in tables, graphs, and maps. Surface drainage is impeded when barrier bars are built by the lake at the mouths of the major streams: Lake Michigan Tributary, Kellogg Ravine, Bull Creek, and Dead River. Periodically, breakthrough events occur which allow the streams to drain. Drainage is poorest in the park area from Wadsworth Road southward. Data show that Bull Creek is rerouted effectively south to Dead River rather than through its natural channel northward under Wadsworth Road. Channelization of Bull Creek directly south to Dead River might be a solution to both roadway flooding and long-term ponding in Dead River. Groundwater dissolved solids ranged between 301 and 1076 milligrams per liter (mg/l), and Dead River dissolved solids ranged between 196 and 491 mg/l. No major hydrologic problems are anticipated in the northward expansion of the park. (Humphreys-ISWS)
W77-12793

A FINITE ELEMENT DISTRIBUTED CATCHMENT MODEL, I. ANALYTICAL BASIS,

King's Coll., London (England). Dept. of Civil Engineering.
A. W. Jayawardena, and J. K. White.
Journal of Hydrology, Vol. 34, No. 3/4, p 269-286, August 1977. 4 fig, 2 tab, 31 ref, 1 append.

Descriptors: *Watersheds(Basins), *Model studies, *Finite element analysis, Runoff, Inflow, Overland flow, Throughfall, Streamflow, Mathematical models, Drainage, Basins, Mathematics, Equations, Hydrology, Hydrographs.
Identifiers: Finite element method, Finite difference method, Throughflow.

The analytical basis for the formulation of a distributed catchment model within the flexible framework of the finite-element method was described. The constitutive equations for the mathematical model were obtained by assuming overland flow conditions in the main drainage paths and through flow conditions elsewhere in the catchment. The solutions in the space and time domains were carried out by using the finite-element method and the finite-difference method, respectively. A hypothetical uniform flow plane was used as an example to compare the numerical solution with that obtained by an analytical method. The same example was used to study the sensitivity of the numerical solution to parameter variations. The accuracy of the solution, the limitations of the procedure, and the potential applications of the approach were indicated. (Sims-ISWS)
W77-12798

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 8. COMPUTER MODELS FOR ENVIRONMENTAL ENGINEERING AND RESEARCH IN NEAR-COASTAL ENVIRONMENTS.

Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
For primary bibliographic entry see Field 2L.
W77-12916

2B. Precipitation

STORM CHARACTERISTICS AND RAINFALL INTENSITY IN WEST VIRGINIA,

West Virginia Univ., Morgantown. Water Research Inst.
R. E. Trent, and W. H. Dickerson.

Field 2—WATER CYCLE

Group 2B—Precipitation

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 638. Price codes: A04 in paper copy, A01 in microfiche. Information Report 8, 1976. 60 p, 16 fig, 6 tab, 54 ref, 3 append. OWRT A-019-WVA(2), 14-31-0001-3049.

Descriptors: *Distribution patterns, *Frequency analysis, *Precipitation(Atmospheric), *Precipitation intensity, *Rainfall intensity, *Storms, *West Virginia, Antecedent precipitation, Diurnal distribution, Frequency, Mathematical models, Rainfall, Statistical methods, Storm structure.

Identifiers: Storm characteristics, Seasonal distribution, Extreme rainfall, Areal distribution.

Hourly precipitation data for 22 weather stations were evaluated to determine the most suitable frequency distribution for fitting the extreme rainfall data; the geographical distribution of intense rainfalls of 1-, 2-, 3-, 6-, 12-, and 24-hour durations; the seasonal and diurnal variations in the occurrence of intense rainfall; and the occurrence of rainfall antecedent to intense rainfall events. The annual series of extreme rainfall events were analyzed by ten mathematical distributions. Gumbel's extreme-value distribution proved most suitable. Delineation of geographical trends of intense rainfall for West Virginia was examined using subjective methods of smoothing isopleths and detecting and adjusting outlier events. To describe the seasonal and diurnal occurrence of intense rainfall and associated antecedent rainfall, hourly records were searched for occurrences of rainfall in excess of the two-year estimates. Summer was the season of maximum frequency of intense rainfall. Frequency decreased with increase in duration and return period. Late afternoon was the time of maximum frequency for short-duration storms, but the early morning hours was the time of maximum frequency for longer-duration storms. July and August were the months of most frequent occurrences of large 5-day antecedent rainfalls.

W77-12261

ATMOSPHERIC ENHANCEMENT OF METAL DEPOSITION IN ADIRONDACK LAKE SEDIMENTS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 5A.
W77-12270

EFFECTS OF SOIL, COVER CROP, AND NUTRIENT SOURCE ON MOVEMENT OF SOIL, WATER, AND NITROGEN UNDER SIMULATED RAIN-SLOPE CONDITIONS,
Ohio Agricultural Research and Development Center, Wooster.
G. D. Hoyt, E. O. McLean, G. Y. Reddy, and T. J. Logan.
Journal of Environmental Quality, Vol 6, No 3, p 285-290, July-September 1977. 2 fig, 7 tab, 22 ref.

Descriptors: *Soil erosion, *Runoff, *Simulated rainfall, *Model studies, *Ohio, Fertilizers, Soils, Nitrogen, Phosphorus, Potassium, Farm wastes, Crops, Slopes, Urea, Rainfall intensity, Time, Leachate, Erosion, Soil contamination.

Nitrogen, P, and K as manure, chemical fertilizers + straw, or chemical fertilizers alone were added to micropots of soils, which were then either cropped to wheat or left bare, and finally subjected to simulated rainfall. The N, P, and K were each applied at 224 kg/ha in the forms of: (1) N- and P-enriched cow manure (7.35 metric tons/ha, dry weight); (2) urea, triple-superphosphate (TSP), and KCl + straw at the same weight of dry matter as the manure; and (3) fertilizers alone. A 5-day rainfall sequence was imposed with varying intensities, durations, and soil slopes. The movement of N generally increased as the quantities of solids, runoff, and leachate increased. Where discrepancies occurred, they could usually be explained by

differences in structure, crusting of the soils, or clogging of their pores by manure, or by effects of straw on soil permeability to water or on increased microbial activity. In general, almost all the mineral N moving in the leachate, and about half of that moving in runoff, was in NO₃ form. (Visocky-ISWS)
W77-12309

USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center; and Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.
For primary bibliographic entry see Field 3B.
W77-12329

WEEKLY WATER BALANCES OF NORMAL AND SEVERE DROUGHT YEARS AT DHARWAR,
University of Agriculture Sciences, Bangalore (India). Dharwar Campus.
B. P. Ratnam, and S. N. Joshi.
Annals of Arid Zone, Vol. 16, No. 1, p 1-4, March, 1977. 1 tab, 6 ref.

Descriptors: *Droughts, *Climatology, *Rainfall, *Water balance, Meteorology, Arid lands, Water shortage, Stress, Moisture stress, Moisture deficit, Agroclimatology, Precipitation(Atmospheric), Air temperature, Evapotranspiration, Crop response, Subhumid climates.

Identifiers: *India, Kharif season.

A study was conducted to determine the weekly water balances of the normal year and severe drought year in the dry sub-humid region of Dharwar, India, in order to reveal the nature of periods with abnormally low rainfall and high water deficiency. The normal values of weekly air temperature and rainfall were obtained as averages for the period 1950 to 1970 from the records of the Agro-Meteorological observatory, College of Agriculture, Dharwar. The weekly potential evapotranspiration values for the normal year, and for 1963, a year of severe drought, were also obtained. Then, the weekly water balances for the two cases were calculated. A comparative study of the weekly water balances of the normal and severe drought years at Dharwar reveals the occurrence of a severe water deficiency during the kharif season. (Jamail-Arizona)
W77-12332

HYDROLOGICAL STUDIES ON SOME RIVER CATCHMENTS IN GREATER LONDON,
Greater London Council, (England. Dept. of Public Health Engineering.
For primary bibliographic entry see Field 2E.
W77-12403

PERFORMANCE OF STORM DRAINAGE SIMULATION MODELS,
For primary bibliographic entry see Field 5D.
W77-12411

METEOROLOGICAL REGIMES FOR THE CLASSIFICATION OF AEROSPACE AIR QUALITY PREDICTIONS FOR NASA-KENNEDY SPACE CENTER,
National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center.
For primary bibliographic entry see Field 5A.
W77-12542

EFFECT OF MISESTIMATING HARMONICS IN PERIODIC HYDROLOGIC PARAMETERS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2E.
W77-12550

MARKOV-DEPENDENT GEOMETRIC MODELS FOR WEATHER SPELLS AND WEATHER CYCLES-A STUDY,
University of Agricultural Sciences, Bangalore (India). Dept. of Statistics.
N. Sundararaj, and S. Ramachandra.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 26, No. 2, p 221-226, April 1975. 1 fig, 4 tab, 5 ref.

Descriptors: *Rainfall, *Precipitation(Atmospheric), *Model studies, Statistical models, Mathematical models, Probability, Markov processes, Frequency analysis, Weather, Meteorology.

Identifiers: *India, *Weather cycles, Dry spells, Wet spells.

The repetitive behavior of seasonal weather has been studied earlier by using a variety of mathematical and probability models. This paper reported an investigation of the empirical validity of Markov-dependent geometric models for wet and dry spells and for weather cycles. The daily rainfall of 50 years' duration served as the data-base for the study. The necessary formulas based on the geometric probability models using Markovian probabilities for dry and wet days were given for lengths of dry spells, wet spells, and wet-dry weather cycles. The data, as judged by Chi square-test, seem to fit better for wet spells than for dry spells. (Sims-ISWS)
W77-12554

AREAL EXTENT OF SOUTHWEST MONSOON DROUGHTS IN INDIA,
Meteorological Office, Poona (India).
C. J. George, V. P. Abhyankar, and G. S. Rentala.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 26, No 2, p 199-202, April 1975. 4 fig, 3 ref.

Descriptors: *Droughts, *Monsoons, *Rainfall, Precipitation(Atmospheric), Correlation analysis, Rainfall disposition, Data processing, Analytical techniques, Agriculture, Meteorology, Foreign countries, Foreign research.

Identifiers: *India.

The areal extent of droughts in India was studied by computing linear correlation between the southwest monsoon rainfall of a particular station (master station), when it gets below-median rainfall, and the corresponding monsoon rainfall of each of 120 other stations forming a well distributed network over the country. The computation was done for 12 master stations selected over different parts of the country. The study showed that droughts in the western parts of the country have comparatively greater areal extent. (Sims-ISWS)
W77-12555

SEVERE FLOODS IN JAMMU AND KASHMIR IN AUGUST 1973,
Meteorological Office, New Delhi (India).
S. K. Ghosh, and K. Veeraraghavan.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 26, No 2, p 203-207, April 1975. 6 fig, 1 tab, 5 ref.

Descriptors: *Floods, *Rainfall, *Air circulation, Precipitation(Atmospheric), Precipitation excess, Rainfall disposition, Storms, Data processing, Meteorology, Foreign countries, Foreign research.

Identifiers: *Jammu and Kashmir(India), *India.

Occurrence of severe flood in Jammu and Kashmir in August 1973 was reported. The meteorological situations responsible for such a severe flood were studied. It was shown that floods in Jammu and Kashmir can occur even in the absence of monsoon depressions and of western disturbances but under the favorable influence of (1) deep penetration of monsoon air into the area, and (2) high level trough-jet system. (Sims-ISWS)
W77-12556

STUDIES OF EARTH SIMULATION EXPERIMENTS,

Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
J. E. Hart.

Available from the National Technical Information Service, Springfield, VA 22161 as N76-33817. Price codes: A04 in paper copy, A01 in microfiche. NASA Contract Report 2753, October 1976. 72 p, 25 fig, 2 tab, 13 ref. NASA NAS8-31149.

Descriptors: *Circulation, *Atmosphere, *Laboratory tests, Fluid mechanics, Dynamics, Convection, Air circulation, Flow, Meteorology, Geophysics.
Identifiers: Electrohydrodynamics, Earth orbit, Thermal distribution.

The 'low gravity' environment of Earth orbit offers the potential for performing experiments involving baroclinic geophysical fluid dynamics (GFD) on spherical surfaces. These experiments, in turn have the potential for providing deeper understanding of large-scale planetary and solar circulations. However, to perform these experiments, one requires an experimental technique whereby a radially directed body force can be generated to simulate a radial gravitational force field. One viable technique is the use of dielectric fluids with temperature dependent dielectric permittivity in a radially directed electric field. Application of the Boussinesq approximation to the equations of motion for this system and restrictions on the size of certain electrodynamic terms in the energy equations yields a set of equations which are analogous to the equations of motions of geophysical systems like the Earth's atmosphere on term-by-term basis. This report described the theoretical design of GFD experiments for performance in Earth orbit along with results of preliminary tests of a prototype. (Sims-ISWS)
W77-12568

TRACER MEASUREMENT OF RIVER EVAPORATION: LABORATORY STUDY,

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 2D.
W77-12771

STOCHASTIC MODELING OF HYDROLOGIC, INTERMITTENT DAILY PROCESSES,

Colorado State Univ., Fort Collins.

J. Kelman.
Hydrology Paper No. 89, February 1977. 60 p, 36 fig, 33 tab, 46 ref, 9 append. NSF 74-17396.

Descriptors: *Time series analysis, *Precipitation(Atmospheric), *Streamflow, *Model studies, *Statistics, Rain gages, Hydrologic data, Computers, Analytical techniques, Methodology.
Identifiers: *Intermittent process, Linear reservoirs, Truncation.

A model for description and generation of new samples of intermittent daily precipitation series was developed. The basic assumption was that precipitation is a result of truncating a non-intermittent process. The univariate non-intermittent process permits an extension to multivariate case. The model was tested on several precipitation stations. Results were found to be satisfactory. Another model for the description and generation of daily streamflow was developed. The rising and falling limbs of discharge hydrograph were modeled individually as two different, intermittent processes, also physically different. The rising limb process is due mainly to factors external to a watershed, and is modeled similarly as the intermittent precipitation process. The falling limb is conceived as governed by regularities of water outflow from watersheds, with the watershed storage and outflow represented by two linear reservoirs. A sequence of recession flows is then a stochastic output from these two reservoirs. (Singh-ISWS)

W77-12796

PRECIPITATION MAPPING WITH AN AIRBORNE SYNTHETIC APERTURE IMAGING RADAR,

National Center for Atmospheric Research, Boulder, Colo.

D. Atlas, C. Elachi, and W. E. Brown, Jr.
Journal of Geophysical Research, Vol. 82, No. 24, p 3445-3451, August 20, 1977. 5 fig, 20 ref.

Descriptors: *Radar, *Precipitation(Atmospheric), *Remote sensing, Aircraft, Rainfall, Winds, Storms, Cloud physics, Data processing, *Mapping, Meteorology.
Identifiers: *Synthetic aperture radar, Doppler radar, Precipitation patterns.

This is the first known report of the mapping of precipitation echoes by an airborne synthetic aperture radar (SAR). The detection and mapping of precipitation by an SAR are complicated by the incoherency of the echoes, which limits the effective signal integration time and the attainable size of the aperture. Observations made with a 3.1-cm SAR with a wide vertical side-looking beam flying above a stratiform storm closely resemble earlier vertical cross sections obtained with conventional radar showing snow trails, the bright band, and rain. However, the actual volume sampled by filtering for zero Doppler is displaced slightly to the up-relative wind (upwind in relation to aircraft) side of the vertical plane along the aircraft track; the more so, the faster the particle fall speeds. A true vertical section requires filtering for Doppler velocities corresponding to the fall speeds. Knowledge of the relative winds and fall speeds permits the generation of isodops in the plane normal to the aircraft and the synthesis of either horizontal or vertical cross sections displaced from the aircraft position. Qualitative information about the relative winds may be deduced from the variation of the bounds of the Doppler spectrum with range. Quantitative wind determination is restricted to well-defined horizontal layers such as the bright band and echo tops. (Sims-ISWS)
W77-12804

PROCEEDINGS OF A CONFERENCE ON EMERGING ENVIRONMENTAL PROBLEMS: ACID PRECIPITATION.

Environmental Protection Agency, New York.

For primary bibliographic entry see Field 5A.

W77-12809

ACID PRECIPITATION: A WORLD CONCERN,

Kungliga Lantbrukshogskolan, Uppsala (Sweden). Dept. of Soil Science; and Kungliga Lantbrukshogskolan, Uppsala (Sweden). Div. of Ecochemistry.

For primary bibliographic entry see Field 5A.
W77-12810

ACID PRECIPITATION: OUR UNDERSTANDING OF THE PHENOMENON,

New York Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.

For primary bibliographic entry see Field 5A.
W77-12811

ACID PRECIPITATION: OUR UNDERSTANDING OF THE ECOLOGICAL EFFECTS,

Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.

For primary bibliographic entry see Field 5A.
W77-12812

HEALTH EFFECTS OF ACID AEROSOLS,

National Environmental Research Center, Research Triangle Park.

For primary bibliographic entry see Field 5A.
W77-12813

WORKSHOP FOR AN ASSESSMENT OF THE PRESENT AND POTENTIAL ROLE OF WEATHER MODIFICATION IN AGRICULTURAL PRODUCTION,

Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

For primary bibliographic entry see Field 3B.
W77-12816

EFFECTS OF FOG DROPLETS ON WAKE VORTEX DECAY RATE,

Tennessee Univ. Space Inst., Tullahoma.

T. H. Moulden, and W. Frost.

Available from the National Technical Information Service, Springfield, VA 22161 as NASA CR-2758. Price codes: A03 in paper copy, A01 in microfiche. Report No. NASA CR-2758, October 1976. 42 p, 9 fig, 2 tab, 17 ref, 1 append. NAS8-29584.

Descriptors: *Vortices, *Fog, *Drops(Fluids), *Theoretical analysis, Aircraft, Air, Analysis, Potential flow, Flow, Movement, Mathematical studies, Mathematical models, Exploration.
Identifiers: Vortex decay.

This exploratory and preliminary report discussed a simple model for the motion of particles in a laminar line vortex. It was assumed that the particles are small, so that a Stokes drag is operative. The energy required to accelerate a set of these particles was determined and was shown to be only a small fraction of the energy content of the vortex flow. It was shown that this energy transfer is unlikely to be sufficient to significantly modify the vortex decay rate. It was argued further that the effect of the particle on the viscous properties of the resulting two-phase fluid would lead to a slower decay rate than would occur in single-phase air flow. However, the conclusion may not necessarily follow for turbulence flows. Results of the study showed that the migration of particles to the outer flow results in a redistribution of the velocity profile in the vortex and in a non-uniform two-phase viscosity across the core. Although not studied, it was suggested that the mentioned effects may accelerate vortex bursting. (Humphreys-ISWS)
W77-12823

A LONG-TERM (1860-1970) CHANGE IN THE REGIME OF BAROMETRIC PRESSURE AT JERUSALEM AND ITS RELATION TO RAINFALL,

Israel Atomic Energy Commission, Yavne.

H. L. Striem.

Israel Journal of Earth-Sciences, Vol. 26, p 24-29, 1977. 4 fig, 6 tab, 9 ref.

Descriptors: *Meteorological data, *Atmospheric pressure, *Forecasting, *Climatology, *Precipitation(Atmospheric), Weather data, Monthly, Weather patterns, Rainfall, Summer, Winter, Wet seasons, Dry seasons, Seasonal, Meteorology, Annual, Temperature, Arid lands.
Identifiers: Barometric pressure, Israel, Jerusalem.

An analysis of mean monthly barometric pressure values in Jerusalem showed the following: a change over the period 1861-1960 in the occurrence of maximum pressure from October/November to December; an increase in the range between minimum pressure (which occurs in the summer) and the winter maximum; and a tendency for extremes to occur later in the year. Annual pressure range was inversely proportional to annual rainfall, thus indicating barometric pressure regimes may be a means of forecasting expected rainfall. (Ulery-Arizona)
W77-12827

Field 2—WATER CYCLE

Group 2C—Snow, Ice, and Frost

2C. Snow, Ice, and Frost

AN ACOUSTIC EMISSIONS MONITORING SYSTEM FOR AVALANCHE SNOWPACKS, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. D. McNair, and F. Wolfe, Jr. Research Note RM-340, Fort Collins, Colorado, April, 1977. 4 p, 3 fig, 1 ref, 1 tab.

Descriptors: *Acoustics, *Avalanches, *Forecasting, Snowpacks, Sounds, Instrumentation, Colorado, Rocky Mountain Region. Identifiers: Berthoud Pass(Colo).

Unstable snow slabs may emit characteristic sounds prior to avalanche. To test this, a low-frequency monitoring system was developed to detect acoustic emissions, and was installed at Berthoud Pass, Colorado. Geophones are located in four known avalanche slide paths. All instrumentation is described. (Witt-IPC) W77-12368

APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE COLORADO, Colorado Univ., Boulder. Inst. of Arctic and Alpine Research. D. H. Knepper.

Available from the National Technical Information Service, Springfield, VA 22161 as N76-17451. Price codes: A02 in paper copy, A01 in microfiche. Interim Report for September-December 1975, January 1976. 20 p, 3 ref. NASA NAS5-20914.

Descriptors: *Remote sensing, *Satellites(Artificial), *Avalanches, *Colorado, Snow packs, Snow cover, Mountains, Hazards, Mapping, Topography, Photography, Aerial photography, Snow, Surveys. Identifiers: *LANDSAT data.

Mapping of avalanche paths on single-band, black and white LANDSAT images by conventional photointerpretation techniques is adversely affected by terrain shadows and the low spatial resolution of the LANDSAT system. Results of this type of mapping are biased towards large paths that are favorably illuminated during imaging; equally large paths under less favorable illumination and most of the smaller paths are only rarely detected. A more consistent evaluation of the avalanche potential of an area can be obtained by analysis of the various topographic factors that control the formation of avalanches including slope angle, aspect, and profile and relief, along with any direct avalanche indicators that may be observed. A evaluation of the size of the avalanches that may be anticipated can be made by estimating the size of potential starting zones. (Sims-ISWS) W77-12567

TRANSITION OF CHEMICAL ELEMENTS INTO WATER EXTRACTS FROM SOILS WITH DIFFERENT MINERALOGICAL COMPOSITIONS, (IN RUSSIAN), Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Institut Pochvovedeniya i Agrokhimii. For primary bibliographic entry see Field 2G. W77-12579

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965 - 1974, NO. 2. PLACE GLACIER, BRITISH COLUMBIA - SUMMARY OF MEASUREMENTS, Department of the Environment, Ottawa (Ontario). Water Quality Branch. O. Mokievsky-Zubok, and A. D. Stanley. Scientific Series No. 69, 1976. 77 p, 1 fig, 8 ref, 5 append.

Descriptors: *Glaciers, *Glaciology, Hydrology, Hydrography, *Measurement, Geology, Meteorology, Parametric hydrology, Elevation, Surface drainage, Ice, Snowmelt, Snow cover, Melt water, Ablation, Average runoff, Data collections, Mapping, Graphic analysis, *Canada. Identifiers: *Place Glacier(Canada), British Columbia, Average net balance, Average summer balance, Average winter balance.

Place Glacier, located in the Coast Mountain Range of British Columbia, is one of five glaciers studied in Western Canada as part of the Canadian contribution to the International Hydrological Decade (IHD). Studies began in 1965. The report describes the main parameters of the glacier, geology of the basin and gives summaries of glaciological, meteorological and hydrological data collected until the end of the 1974 field season, together with reference to special studies on the glacier. (See also W77-12789, W77-12790, W75-06732, W75-06740, and W75-06741) (WATDOC) W77-12788

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965 - 1974, NO. 3. RAM RIVER GLACIER, ALBERTA - SUMMARY OF MEASUREMENTS, Department of the Environment, Ottawa (Ontario). Water Resources Branch. G. J. Young, and A. D. Stanley. Scientific Series No. 70, 1976. 54 p, 2 fig, 7 ref, 2 append.

Descriptors: *Glaciers, *Glaciology, Hydrology, Hydrography, *Measurement, Geology, Meteorology, Elevation, Parametric hydrology, Ice, Snow, Ablation, Altitude, Humidity, Temperature, Data collections, Mapping, Graphical analysis, *Canada. Identifiers: *Ram River Glacier(Canada), Alberta, Net annual balance, Net winter balance, Mass balance.

A summary is given of work performed within the glacier basin during the International Hydrological Decade, 1965 - 74. The data collected fall into three categories, glaciological, meteorological and hydrological. The glaciological work is primarily concerned with glacier mass balance. The measurements of accumulation and ablation are described and annual summaries are given in the form of maps and tables. The collection of meteorological data near the glacier and the gathering of stream discharge data immediately below the glacier is described and illustrated in graphical form. (WATDOC) (See also W77-12788) W77-12789

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965-1974, NO. 4. PEYTO GLACIER, ALBERTA - SUMMARY OF MEASUREMENTS, Department of the Environment, Ottawa (Ontario). Water Resources Branch. G. J. Young, and A. D. Stanley. Scientific Series No 71, 1976. 59 p, 3 fig, 55 ref, 2 append.

Descriptors: *Glaciers, *Glaciology, Hydrology, Hydrography, *Measurement, Geology, Meteorology, Parametric hydrology, Temperature, Precipitation (Atmospheric), Ice, Snow, Ablation, Data collection, Mapping, Graphical analysis, *Canada.

Identifiers: *Peyto Glacier(Canada), Banff National Park, Alberta, Net annual balance, Net winter balance, Mass balance.

A summary is given of work performed within the glacier basin during the International Hydrological Decade 1965 - 74. The data collected fall into three categories, glaciological, meteorological and hydrological. The glaciological work is primarily concerned with glacier mass balance. The mea-

surements of accumulation and ablation are described and annual summaries are given in the form of maps and tables. The collection of meteorological data near the glacier and the gathering of stream discharge data immediately below the glacier is described and illustrated in graphical form. (WATDOC) (See also W77-12788) W77-12790

GLACIOLOGICAL DATA, THIS ISSUE: AVALANCHES. World Data Center A for Glaciology, Boulder, Colo. Report GD-1, 1977. 134 p, 7 fig, 3 tab, 53 ref, 1 append.

Descriptors: *Avalanches, *Reviews, *Disasters, *Bibliographies, *United States, Snow, Safety, Foreign research, Foreign countries, Zoning, Regulation, Non-structural alternatives, Land use, On-site investigations, Operations. Identifiers: *Iceland, *Switzerland, *USSR, Avalanche research.

The brief articles and related material were intended to provide perspectives on data problems and data applications in the context of avalanches. Subjects presented included an annotated glossary of avalanche terms; procedures and problems in avalanche data collections; avalanche activities at the Rocky Mountain Forest and Range Experiment Station 1977; avalanche damage and avalanche protection in Switzerland; Soviet avalanche research; snow avalanche studies in Iceland; and a report on the avalanche workshop, Banff, Alberta, November 1976. Also included was a selected bibliography, 1950-77, with 643 entries and abbreviations used in bibliography. Glaciological Data supercedes a previous publication titled Glaciological Notes. (Humphreys-ISWS) W77-12799

AEROSPACE RESEARCH OF THE ENVIRONMENT. GEOBOTANY, SOIL SCIENCE, AND HYDROLOGY. For primary bibliographic entry see Field 7B. W77-12820

MEASURING SNOW COVER USING SATELLITE IMAGERY DURING 1973 AND 1974 MELT SEASON: NORTH SANTIAM, BOISE, AND UPPER SNAKE BASINS, Stanford Research Inst. Menlo Park, Calif. E. J. Wiegman, W. E. Evans, and R. Hadfield. Available from the National Technical Information Service, Springfield, VA 22161 as N76-16600. Price codes: A06 in paper copy, A01 in microfiche. Final Report, Phase I, SRI Project 4122, July 1975. 81 p, 34 fig, 6 tab, 1 ref, 1 append.

Descriptors: *Remote sensing, *Idaho, *Wyoming, *Snow cover, *Oregon, *Snowmelt, *Columbia River, Snow, Satellites(Artificial), Surveys, Snowpacks, Watersheds(Basins), Water resources, Measurement, Data processing, Analytical techniques. Identifiers: *LANDSAT data.

Measurements of snow coverage during the snowmelt season in 1973 and 1974 were gathered from LANDSAT imagery for the following Columbia River Subbasins: North Santiam Basin (above Detroit Dam), Oregon; Boise Basin (above Lucky Peak), Idaho; and Upper Snake River Basin (above Palisades Dam), Wyoming. Single-band radiance thresholding was the principal technique employed in the snow detection, although this technique was supplemented by an editing procedure involving reference to hand-generated elevation contours. For each data and view measured, a binary thematic map or 'mask' depicting the snow cover was generated by a combination of objective and subjective procedures. Each mask was documented through three different methods:

photography; a numerical pixel count representative of the total area of snow in the scene and within the basin boundary; and, an array of single digit numbers depicting tenths of snow cover for each 2.5 x 2.5 km cell within the basin. The cell-by-cell numeric documentation procedure provides a convenient and effective means of comparing the ESIA-derived results with findings obtained by more conventional photointerpretation or with ground or aircraft surveys. More important, the cell-by-cell machine documentation paves the way for the use of advanced basin modeling procedures—for example, those requiring that snowpack be inventoried in elevation increments. (Sims-ISWS)
W77-12821

2D. Evaporation and Transpiration

MODELING SOIL WATER MOVEMENT FOR TRICKLE IRRIGATION - PHASE II, Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W77-12256

WATER RELATIONS AND PHOTOSYNTHESIS OF A DESERT CAM PLANT, AGAVE DESERTI, California Univ., Los Angeles. Dept. of Biology. P. S. Nobel.
Plant Physiology, Vol. 58, No. 4, p 576-582, October, 1976. 7 fig, 2 tab, 24 ref.

Descriptors: *Photosynthesis, *Desert plants, *Plant physiology, *Soil-water-plant relationships, *Water balance, *Transpiration, Water loss, Stomata, Rainfall, Leaves, Physiological ecology.
Identifiers: *Agave deserti, Colorado desert.

The water relations and photosynthesis of a crassulacean acid metabolism plant, Agave deserti, were measured in the Colorado desert. Stomatal opening could be induced by watering, though it did not occur naturally in the summer. The relatively shallow root system allows the plant to respond rapidly to rainfall and its succulent leaves permit the continued opening of the stomata for up to eight days after the soil has become drier than the plant itself. Leaf water vapor diffusion resistance increased five-fold following a night time leaf temperature increase of from 5 to 20 degrees centigrade. This indicates the importance of cool night time temperatures for gas exchange. Most carbon uptake occurs at night, although there can be a secondary light-dependent carbon dioxide intake after dawn. The ratio of water transpired to carbon fixed was about 25 over the entire year. (Fronsdorf-Arizona)
W77-12292

EVAPOTRANSPIRATION AND SOIL WATER MOVEMENT BENEATH THE ROOT ZONE OF IRRIGATED AND NONIRRIGATED MILLET (PANICUM MILIACEUM), Agricultural Research Service, Florence, S.C. D. C. Reicosky, C. W. Doty, and R. B. Campbell.
Soil Science, Vol 124, No 2, p 95-101, August 1977. 7 fig, 1 tab, 17 ref.

Descriptors: *Evapotranspiration, *Soil water movement, *Root zone, *Model studies, Darcys law, Hydraulic gradient, Irrigation, Loam, Hydraulic conductivity, Moisture stress, Crop production.
Identifiers: *Millet.

A water balance was estimated for irrigated and nonirrigated millet grown in a Varina sandy loam. The millet was harvested periodically during the 1970 growing season. Evapotranspiration (ET) was calculated using the water balance equation; all elements, except the subsurface drainage, were measured directly. The subsurface drainage was estimated, using the Darcy equation, to determine

the net soil water flux into and out of the root zone. The ET calculated from the irrigated plots agreed well with potential ET values computed using the combination equation. Hydraulic gradient data in nonirrigated plots showed that water moved upward for most of the season. During one drought, the upward flux accounted for about 34% of the calculated ET. Although the total amount of water moving upward was small, it provided enough water for the crop to subsist until rainfall was adequate. (Visocky-ISWS)
W77-12315

EVAPORATIVE COOLING OF PEACH TREES TO BREAK REST AND DELAY BLOOM, Georgia Univ., Athens. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12512

SALINITY EFFECTS ON CORN YIELD, EVAPOTRANSPIRATION, LEACHING FRACTION, AND IRRIGATION EFFICIENCY, California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 3C.
W77-12747

TRACER MEASUREMENT OF RIVER EVAPORATION: LABORATORY STUDY, Canada Centre for Inland Waters, Burlington (Ontario). Y. L. Lau.
Scientific Series No. 73, Fisheries and Environment Canada, Ottawa, Canada, 1977. 19 p, 10 fig, 11 ref, 1 tab.

Descriptors: *Tracers, *Evaporation, *Measurement, *Wind velocity, *Water vapour, *Water loss, Tritium, Turbulence, Air circulation, Air-water-interfaces, Heat balances, River basins, Experimental models, Laboratory tests, Analysis, Winds.
Identifiers: *Wind tunnels.

Experiments were performed in a small wind tunnel in which the wind blew over a basin of water containing tritium. Evaporation rates for water vapour and tritium were measured. The results show that the wind function for water evaporation and that for tritium evaporation were affected to about the same degree by turbulence in the air. However, turbulence in the water greatly increased the evaporation rate of the tritium but not that of the water. Application of the laboratory measurements to the development of a method for measuring river evaporation is discussed. (WATDOC)
W77-12771

DEVELOPMENT AND EVALUATION OF EVAPOTRANSPIRATION MODELS FOR IRRIGATION SCHEDULING, Agricultural Research Service, Kimberly Idaho. Snake River Conservation Research Center.
For primary bibliographic entry see Field 3F.
W77-12779

EVAPOTRANSPIRATION POTENTIAL UNDER TRICKLE IRRIGATION, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12780

2E. Streamflow and Runoff

URBAN RUNOFF DIGITAL COMPUTER MODEL, Khonkaen Univ. (Thailand). Dept. of Civil Engineering. S. Phamwon, and Y-S. Fok.

American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 103, No HY7, p 723-735, July 1977. 9 fig, 5 tab, 9 ref, 2 append.

Descriptors: *Urban runoff, *Computer models, *Urban hydrology, *Watersheds(Basins), *Infiltration, *Hawaii, Analytical techniques, Rainfall-runoff relationships, Urban drainage, Flood control, Computers, City planning.
Identifiers: *Kinematic wave equations, *St Louis Heights Watershed(Hawaii).

A digital computer model for simulating runoff from small urban watersheds was developed. The model utilized a numerical solution of the kinematic wave equations for overland flow and channel flow routing. The runoff from previous areas was estimated by utilizing appropriate infiltration curves whose initial and final infiltration rates varied, depending upon the soil type and moisture conditions. Runoff from paved and grassed areas was combined and routed through the gutter to sewer inlets, and the flow in the sewers was routed from one inlet to the other in the downstream direction. The model was tested on St. Louis Heights watershed in Hawaii. The slopes of the streets range from 1 to 29%. For the five storm events tested, the simulated peak flows were in the acceptable range of the observed. The choice of infiltration curves was shown to affect considerably the time to and the magnitude of the peak discharge. (Singh-ISWS)
W77-12316

FLAWS OF SODIUM, POTASSIUM, MAGNESIUM AND CALCIUM IN THE R. CYNON, S. WALES, University of Wales Inst. of Science and Technology, Cardiff (Wales). Dept. of Applied Biology.
For primary bibliographic entry see Field 5B.
W77-12320

PREDICTION OF LONGITUDINAL DISPERSION IN NATURAL STREAMS, Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering. F. B. Pederson.
Series Paper No. 14, February 1977. 69 p, 15 fig, 19 ref, 1 append.

Descriptors: *Dispersion, *Forecasting, *Natural streams, Mathematical models, Streams, Mathematical studies, Hydraulics, Foreign research, Equations, Model studies.
Identifiers: Non-Fickian behavior, Dispersion processes.

Current models used to describe one-dimensional longitudinal dispersion in natural streams were examined critically. It was shown that provided the stream can be classified as 'uniform', a model which takes account of the convective period, the uneven lateral distribution of the velocity, and the existence of dead-zones, can account for the commonly observed non-Fickian behavior and the skewed concentration distribution (long tails). The equation describing the dispersion process can be solved only numerically, and to this end, 4 model parameters are needed. A systematic analysis of the sets of data compiled and published by Nordin and Sabol was performed. From the analysis a set of prediction formulas for the 4 necessary parameters was obtained. It was shown that the dimensionless variance versus the dimensionless time can be presented as a one-parameter family, the parameter being the friction factor. (Lee-ISWS)
W77-12330

FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN: PART I - EFFECTS OF RAYSTOWN LAKE ON THE LOW-FLOW FREQUENCY CHARACTERISTICS OF THE JU-

Field 2—WATER CYCLE

Group 2E—Streamflow and Runoff

NIATA AND LOWER SUSQUEHANNA RIVERS, PENNSYLVANIA,
Geological Survey, Harrisburg, Pa. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-12380

TEMPERATURE OF MISSOURI STREAMS,
Geological Survey, Rolla, Mo. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12385

HYDROLOGICAL STUDIES ON SOME RIVER CATCHMENTS IN GREATER LONDON,
Greater London Council, (England. Dept. of Public Health Engineering.
K. Butters, and A. Vairavamoorthy.
Proceedings of the Institution of Civil Engineers, Part 2, Vol. 63, p 331-361, June, 1977. 18 fig, 3 tab, 9 ref.

Descriptors: *Hydrologic data, *Floods, *Analytical techniques, *Model studies, *Watersheds(Basins), Hydrographs, Storms, Computer models, Rainfall-runoff relationships, Unit hydrographs, Data collections, Precipitation(Atmospheric), Storm runoff, Urban drainage, Urban runoff, Storm water, Waste water treatment.
Identifiers: Thames River, *London, England.

Hydrologic studies were prepared by the Department of Public Health Engineering of the Greater London area. A system for the collection of rainfall and runoff was developed to better predict storm runoff and flooding and to determine hydrologic trends. Using flood hydrographs and other hydrologic data, an equation was developed to predict flood damage on the basis of flood water volume. The effects of catchment area, travel time of excess rainfall, climatological influences, and catchment topography were considered in hydrologic analysis. Duration and intensity were examined for individual storms, and 30-year trends were examined. A series of 250 storms, said to represent a 100-year period, were simulated. Analytical methods and parameters considered in the study were: time of equilibrium, the Wandle study for the preparation of flood hydrographs, peak discharges for rainfall and runoff probabilities, the unit hydrograph, synthetic unit hydrograph, and simulated point rainfall. A flow network for the digitization of rainfall data was presented. An examination of parameters taken into account by the various methods for calculating rainfall indicated that the synthetic hydrograph was the most complete analytical method, accounting for catchment area, slope, storage, and shape; rainfall intensity and profile storm pattern; and runoff coefficient. (Shulz-FIRL)
W77-12403

QUALITY OF URBAN FREEWAY STORM WATER,
Wisconsin Dept. of Transportation, Madison. Div. of Highways.
For primary bibliographic entry see Field 5B.
W77-12500

DRAG REDUCTION IN TURBULENT FLOW OF POLYMER SOLUTIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-12541

THE GEOCHEMISTRY OF MANGANESE, IRON, URANIUM, LEAD-210, AND MAJOR IONS IN THE SUSQUEHANNA RIVER,
Yale Univ., New Haven, Conn. Graduate School.
For primary bibliographic entry see Field 2K.
W77-12544

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME IV. OVERLAND FLOW ON AREAS SUBJECT TO INFILTRATION LOSSES,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W77-12547

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME V. A DIMENSIONLESS HYDROGRAPH FOR ESTIMATING STORM RUNOFF FROM URBAN AREAS,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W77-12548

EFFECT OF MISESTIMATING HARMONICS IN PERIODIC HYDROLOGIC PARAMETERS,
Colorado State Univ., Fort Collins.
K. L. Bullard, V. Yevjevich, and N. Kottegoda.
Hydrology Papers, No. 88, November 1976. 29 p, 10 fig, 13 tab, 24 ref.

Descriptors: *Statistical models, *Time series analysis, *Hydrologic properties, Analytical techniques, *Stochastic processes, Hydrology, Computer models, Equations, Model studies, Mathematical studies.
Identifiers: *Periodic-stochastic models, Harmonic analysis, Auto correlation, Periodic functions, Structure of time series, Residual stochastic series, Hydrologic time series.

The periodic-stochastic model, used to describe the structure of historic hydrologic time series, was examined in the light of finding that the model distorts the distribution of residuals or of the time-independent stochastic component under certain circumstances. In general, the distortion caused the distribution of an independent stochastic component to have a sharper peak, and sometimes the distortion appears to follow a double branch exponential distribution function. The apparent cause for distortion is the failure of the least-squares method to accurately estimate amplitudes and phases of harmonic in periodic parameters of historic data. The unremoved and/or misestimated dependence of the autoregressive type in stochastic component was found also to affect the inferred distribution of residuals. The investigation method used is by generating new samples of given sizes and properties by the classical Monte Carlo method. (Adams-ISWS)
W77-12550

STREAM-CHANNEL RESPONSE TO FLOODS, WITH EXAMPLES FROM CENTRAL TEXAS,
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W77-12553

SEVERE FLOODS IN JAMMU AND KASHMIR IN AUGUST 1973,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 2B.
W77-12556

KNIFE RIVER FLOOD HAZARD ANALYSES, MERCER COUNTY, NORTH DAKOTA.
Soil Conservation Service, Bismarck, N. Dak.
Prepared for County of Mercer, and Cities of Stanton, Hazen, Beulah, and Zap, ND, January 1977. 34 p, 15 fig, 42 plates, 2 tab.

Descriptors: *North Dakota, *Flood frequency, *Peak discharge, *Land use, *Flood data, Flooding, Flood flow, Indirect flood measurement, Streamflow forecasting, Flood forecasting, Historic floods, Floods, Flood peak, Flood plains, Flood protection, Non-structural alternatives, Flood plain zoning, Flood plain insurance, Warn-

ing systems, Building codes, Planning, Flood routing, Levee, Dams.
Identifiers: *Knife River(ND), Mercer County(ND), Zap(ND), 500-year flood, 100-year flood, 50-year flood, 20-year flood, 10-year flood.

The study area involves the Knife River in Mercer County, North Dakota, and includes the cities of Stanton, Hazen, Beulah, and Zap. The Knife River drainage lies within the glaciated portion of the Missouri Plateau physiographic area. It has surface features typical of both glaciated and unglaciated areas. Flood data were obtained from U.S. Geological Survey (USGS) stream gages, channel cross section surveys, Weather Bureau data, and Soil Conservation Service (SCS) materials. With some exceptions, March and April are the main flood season. Flooding results from snowmelt runoff and frozen soil conditions. The largest flood recorded at the Hazen gaging station occurred in June, 1966. The flood is described as a 20-year frequency flood. A 30-year frequency flood occurred in March of 1943. The 10, 50, 100, and 500-year frequency floods are graphed, and the predicted extent of the 100-year frequency flood is mapped. These data are intended for use in the development of a flood plain management program that integrates appropriate structural and non-structural controls. Specific recommendations for this area involve adoption of local flood plain land use and zoning regulations, installation of structural control in developed areas, flood proofing, application for flood insurance, and reservation of flood hazard areas for use as parks. (Nessa-NC)
W77-12592

STOCHASTIC APPROACH TO THE COLORADO RIVER BASIN,
Bureau of Reclamation, Denver, Colo. Water Utilization Branch.
For primary bibliographic entry see Field 4D.
W77-12724

STOCHASTIC MODELING OF HYDROLOGIC, INTERMITTENT DAILY PROCESSES,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2B.
W77-12796

A FINITE ELEMENT DISTRIBUTED CATCHMENT MODEL, I. ANALYTICAL BASIS,
King's Coll., London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-12798

STREAM NETWORK VOLUME: AN INDEX OF CHANNEL MORPHOMETRY,
Southampton Univ. (England). Dept. of Geography.
K. J. Gregory.
Geological Society of America Bulletin, Vol. 88, No. 8, p 1075-1080, August 1977. 2 fig, 4 tab, 34 ref.

Descriptors: *Channel morphology, *Drainage density, *Watersheds(Basins), *Channel flow, *Australia, Foreign countries, Foreign research, Overland flow, Geomorphology, Hydrology, Peak discharge, Drainage systems, Surface waters, Analytical techniques, Flow.
Identifiers: *New South Wales(Australia), *Stream network volume, Fluvial geomorphology, Channel size.

Stream or drainage density reflects the potential rate at which water can be transmitted through a basin as well as the climatic features and basin characteristics. Density is a fundamentally significant index in fluvial geomorphology studies. A valid comparison of drainage density in several areas can be made only if the stream channel size

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Groundwater—Group 2F

is constant in all areas. It is desirable to combine an index of channel size or channel capacity with data on stream density. An index of the volume of the drainage network could be employed to compare the same network at two or more stages in time. A volumetric index was developed by integrating the regression equation which relates channel capacity to total stream length between network limits. The measure of the volume of the network was illustrated for two basins in New South Wales, Australia, which have different drainage densities but have comparable network volumes. Because channel flow is usually more rapid than overland flow or through flow, the index of network volume is potentially useful to establish relationships between channel form and peak discharge and also as a basis for improved flow prediction. (Singh-ISWS)
W77-12802

THE RESPONSE OF FLOODS AND SEDIMENT YIELDS TO CLIMATIC VARIATION AND LAND USE IN THE UPPER MISSISSIPPI VALLEY.
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
J. C. Knox, P. J. Bartlein, K. K. Hirschboeck, and R. J. Muckenhirn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-247 086, Price codes: A05 in paper copy, A01 in microfiche. IES Report No. 52, NSF-RA-E-75-053, August 1975. 76 p, 24 fig, 15 tab, 25 ref. NSF-RANN GI-29731.

Descriptors: *Mississippi River Basin, *Sediment yield, *River basin development, *Wisconsin, *Rainfall-runoff relationships, *Flood recurrence interval, Floods, Climates, Hydrology, Hydrologic cycle, Sediment load, Geomorphology, Precipitation (Atmospheric), Flood stages.
Identifiers: Upper Mississippi River Basin.

Flooding and sediment yield responses were identified, described, and calibrated in terms of the interactions between climatic systems and hydrologic systems. A major focus of the project was related to the impact of climatic variability as determined by patterns of upper atmospheric circulation. Attention was also devoted to the varying impacts of climatic-hydrologic interactions as distributed over watersheds that differ according to size and land use. Six data sets were used to study interactions between climatic systems and hydrologic systems as they impact floods and sediment yields in parts of the Upper Mississippi Valley. The data sets included: (1) monthly precipitations, (2) monthly frequencies of upper atmospheric circulation regimes, (3) daily frequencies of upper atmospheric circulation regimes, (4) flood discharges defined relative to a partial duration series base for each of 29 watersheds, (5) sediment yields related to surface runoff for 27 watersheds, and (6) field survey data representing post-1832 land use impacts on a large southwestern Wisconsin watershed. (Adams-ISWS)
W77-12822

2F. Groundwater

HYDROCHEMICAL ZONALITY OF GROUNDWATERS IN THE ARID ZONES OF THE USSR, Akademiya Nauk SSSR, Moscow. Interagency Geophysical Committee.
For primary bibliographic entry see Field 2K.
W77-12311

THE GROUNDWATER RESOURCES OF URUGUAY.
Israel National Oil Co., Ltd., Tel Aviv.
For primary bibliographic entry see Field 4B.
W77-12312

BINARY GAS DIFFUSION OF METHANE-NITROGEN THROUGH POROUS SOLIDS,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
L. Y. Chen, D. L. Katz, and M. R. Tek.
American Institute of Chemical Engineers Journal, Vol 23, No 3, p 336-341, May 1977. 7 fig, 5 tab, 9 ref.

Descriptors: *Diffusion, *Nitrogen, *Methane, *Porous media, *Cores, Gases, Steady flow, Porosity, Permeability, Resistivity, Laboratory tests, Analytical techniques, Sandstones.
Identifiers: Dry cores, Saturated cores, Tortuosity.

Diffusion rates of nitrogen and methane were measured across 10 porous solids at 35C and 1 atm by a steady-state flow method. The porous plugs used were cylindrical in shape, with diffusion occurring in the direction of the axis. Diffusion data were taken with porous cores either dry or saturated with liquids. Water and n-heptane were used as saturating liquids. The rather complex internal structure of porous solids were characterized indirectly through some auxiliary measurements. The measurements included porosity, permeability, and electrical resistivity factor (yet another indirect measurement of tortuosity). The effective diffusion coefficients were correlated for the gas phase diffusion as a function of porosity. The ratio of effective diffusion coefficient to the open space diffusion coefficient (D_e/D_o) was correlated for dry cores using the properties approximately characterizing the pore structure. (Visocky-ISWS)
W77-12323

WATER-LEVEL RECORDS FOR THE LOWER ARKANSAS RIVER VALLEY OF COLORADO, 1973-77,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12370

WELL RECORDS, WATER-LEVEL MEASUREMENTS, LOGS OF TEST HOLES, AND CHEMICAL ANALYSES OF GROUND WATER IN THE CACHE RIVER ALLUVIAL AQUIFER-STREAM SYSTEM, NORTHEAST ARKANSAS, 1946-76,
Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12371

WATER-LEVEL RECORDS FOR ADAMS, LARIMER, LOGAN, MORGAN, SEDGWICK, WASHINGTON, AND WELD COUNTIES, COLORADO, 1973-77,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12373

AVAILABILITY OF WATER IN THE FLORIDAN AQUIFER IN SOUTHERN DUVAL AND NORTHERN CLAY AND ST. JOHNS COUNTIES, FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-12374

GROUND-WATER DISCHARGE FROM THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1976,
Geological Survey, San Antonio, Tex. Water Resources Div.
R. A. Rappmund.
Edwards Underground Water District, San Antonio, Texas, Bulletin 36, July 1977. 8 p, 1 tab, 16 ref.

Descriptors: *Groundwater resources, *Water wells, *Springs, *Water yield, *Aquifers, Texas, Water users, Data collections, Limestones.
Identifiers: *San Antonio area (Tex), Edwards aquifer.

The estimated total discharge from wells and springs in the Edwards and associated limestones in the San Antonio, Texas; area during 1976 was 853,400 acre-feet. This was about 2 percent less than in 1975 and about 50 percent more than the average for 1934-75. About 41 percent of the total discharge was from wells, and approximately two-thirds of this amount was from wells in Bexar County. The discharge from wells in 1976 was 6 percent more than in 1975; springflow decreased by about 7 percent. (Woodard-USGS)
W77-12376

THEORETICAL DRAWDOWN DUE TO SIMULATED PUMPAGE FROM THE OHIO RIVER ALLUVIAL AQUIFER NEAR SILOAM, KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-12379

TEST-WELL DRILLING IN THE UPPER SATUS CREEK BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, Wash. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-12384

HYDROGEOLOGIC DATA FROM INVESTIGATION OF WATER RESOURCES OF THE SOUTH FORK, SUFFOLK COUNTY, NEW YORK,
Geological Survey, Mineola, N.Y. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12390

SIMULATION PROCEDURE FOR MODELING TRANSIENT WATER-TABLE AND ARTESIAN STRESS AND RESPONSE,
Geological Survey, Little Rock, Ark. Water Resources Div.; and Geological Survey, Lakewood, Colo. Water Resources Div.
J. E. Reed, M. S. Bedinger, and J. E. Terry.
Open-file Report 76-792, 1976. 173 p, 18 fig, 7 tab, 16 ref.

Descriptors: *Computer models, *Computer programs, *Groundwater movement, Parametric hydrology, Mathematical models, Soil moisture, Artesian aquifers, Pressure.
Identifiers: *Groundwater models.

The series of computer programs described in this report were designed specifically to model the ground-water regime in sufficient detail to determine the effects of the imposition of various types of stress upon the system, and to display the results in a convenient manner during calibration and when presenting projected data. SUPER-MOCK simulates the ground-water system and DATE and HYDROG aid in the display of computed data. During calibration, DATE is especially useful because it has the optional feature of comparing computed data with observed data. Although the programs can be run independently, experience dictates that for best results the three should be run as steps in the same job. English units of inches, feet, and days are used in each of the programs. The units for any parameters not given in the text are clearly specified in the instructions for input to the individual programs. (Woodard-USGS)
W77-12391

Field 2—WATER CYCLE

Group 2F—Groundwater

GROUNDWATER LEVELS IN NEBRASKA, 1976, Geological Survey, Lincoln, Nebr. Water Resources Div.; and Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 4B.
W77-12393

THE GEOCHEMISTRY OF MANGANESE, IRON, URANIUM, LEAD-210, AND MAJOR IONS IN THE SUSQUEHANNA RIVER, Yale Univ., New Haven, Conn. Graduate School.
For primary bibliographic entry see Field 2K.
W77-12544

AN EMPIRICAL METHOD FOR SIMULATION OF WATER TABLES BY DIGITAL COMPUTERS, Nevada Univ., Reno. Water Resources Center. C. L. Carnahan, and P. R. Fenske.
Available from the National Technical Information Service, Springfield, VA 22161 as NVO-1253-7. Price codes: A03 in paper copy, A01 in microfiche. Report NVO-1253-7, September 1975. 34 p, 8 fig, 13 ref. ERDA AT (29-2)-1253.

Descriptors: *Computer models, *Water table, *Nevada, *Great basin, Arid lands, Topography, Regression analysis, Water levels, Potentiometric level, Elevation, Groundwater recharge, Hydraulic gradient, Hydraulic conductivity, Discharge(Water), Springs, Model studies, Computer programs.
Identifiers: *Subdued topography, Empirical method.

An empirical method was described for computing a matrix of water table elevations from a matrix of topographic elevations and a set of observed water-elevation control points which may be distributed randomly over the area of interest. The method is applicable to regions, such as the Great Basin, where the water table can be assumed to conform to a subdued image of overlying topography. A first approximation to the water table was computed by smoothing a matrix of topographic elevations and adjusting each node of the smoothed matrix according to a linear regression between observed water elevation and smoothed topographic elevations. Each observed control point was assumed to exert a radically decreasing influence on the first approximation surface. The first approximation then was adjusted further to conform to observed water table elevations near control points. Outside the domain of control, the first approximation was assumed to represent the most probable configuration of the water table. The method was applied to the Nevada Test Site and the Hot Creek Valley areas in Nevada. (Visocky-ISWS)
W77-12546

UNDERGROUND RESERVOIRS TO CONTROL THE WATER CYCLE, Food and Agricultural Organization of the United Nations, Rome (Italy). R. P. Ambroggi.
Scientific American, Vol. 236, No. 5, p 21-27, May, 1977. 6 fig.

Descriptors: *Groundwater, *Recharge, *Conjunctive use, *Underground storage, Hydrologic cycle, Artificial recharge, Reservoir storage, Irrigation, Irrigation canals, Drawdown, Water table.
Identifiers: Indus River Basin(Pakistan).

Casual glances at the hydrologic cycle overlook the vast amount of water stored in the subsurface environment. In light of current crises in water management for agricultural and other purposes, ground water resources could be tapped to a much greater degree than at present; it is suggested that mankind should deliberately draw down underground reservoirs to a considerable extent with

the intent of planned subsurface storage by means of natural or artificial recharge. Experience over the past three decades has shown that a single year of heavy rainfall can restore an aquifer that has suffered declining water levels for several years previous. An aquifer that has been drawn down very little, on the other hand, cannot be employed for additional long-term storage. Overexploitation, in conjunction with recharge procedures, is perhaps the best policy for worldwide water management in the future. Joint operation of surface and underground reservoirs will alleviate both seasonal and long-term deficiencies in water. If governments and water managers are prepared to make decisions in favor of such operations, the technology will be available to make them feasible. (Eberle-NWWA)
W77-12667

TWO-PHASE, TWO-DIMENSIONAL SIMULATION OF A GEOTHERMAL RESERVOIR, Chevron Oil Field Research Co., La Habra, Calif. R. M. Toronyi, and S. M. Farouq Ali.
Society of Petroleum Engineers Journal, Vol. 17, No. 3, p 171-183, June, 1977. 17 fig, 29 ref, 2 append.

Descriptors: *Geothermal studies, *Thermal waters, *Mathematical models, Steam, Thermal power, Aquifers, Reservoirs, Porous media, Porosity, Permeability, Pressure, Convection, Heat transfer, Mass transfer.
Identifiers: *Two-phase geothermal systems.

Reservoir engineering principles have been used to study production aspects of geothermal systems only during the past decade. In that time, relatively few models have been developed that simulate the production from a geothermal reservoir containing both a liquid and a vapor phase. Thus, the objective of this paper is to develop a model that simulates production from a two-phase geothermal reservoir in greater detail than has been done previously. The model is a two-dimensional areal or cross-sectional, unsteady state description of the flow of mass and heat within an anisotropic, heterogeneous porous medium containing a single-component, two-phase fluid. Flow in the production well was taken to be one dimensional and steady state, using an approximate representation of a two-phase mixture. Based on numerical results, the behavior of a two-phase geothermal reservoir was classified into three types, depending upon the original liquid saturation. It was found that superheated regions formed more readily in reservoirs of low porosity and permeability. Both areal and cross-sectional formulations produced stable solutions under large time-step sizes. (Eberle-NWWA)
W77-12674

HOT DRY ROCK: WIDESPREAD BUT INVISIBLE, Los Alamos Scientific Lab., N. Mex.
For primary bibliographic entry see Field 8E.
W77-12681

CYCLICAL ENERGY TRANSFER METHOD AND APPARATUS, Cyclical Energy Transfer Method and Apparatus, C. K. Greene.
U.S. Patent No 4,022,025, 6 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 521, May 10, 1977.

Descriptors: *Patents, *Geothermal studies, *Energy transfer, *Heat flow, Temperature, Thermal conductivity, Thermal properties, Aquifer management.

This is a method and apparatus used for the utilization of geothermal energy for the production of power. A fluid (stream and/or hot liquid, or the like) from a geothermal aquifer is brought up to the surface through several wells of a group and

returned as condensate after passing through an energy extractor through another well, or wells of the group. A reversible flow arrangement is provided whereby the fluid may be taken from different wells and utilized with the condensate going back through different wells successively and in turn by means of which salt deposits are eliminated, the heat of the aquifer is maintained, and maximum energy extraction is achieved. By the injection of additional water into the condensate manifold, additional values may be achieved, both in enhancing the action of the steam in passing through the energy extractor, and in creating an accelerated dissolving action upon the solids which may have been deposited in the well or wells now receiving the condensate. The object of this invention is to provide a system for utilizing fluid from adjacent wells so that reverse flow is achieved such that adjacent wells alternately dispense fluid and receive condensate or other return material. (Sinha-OEIS)
W77-12697

GEOTHERMAL INVESTIGATIONS IN IDAHO: PART 7, GEOCHEMISTRY AND GEOLOGIC SETTING OF THE THERMAL WATERS OF THE CAMAS PRAIRIE AREA, Idaho Dept. of Water Resources, Boise.
For primary bibliographic entry see Field 4B.
W77-12782

HYDROLOGIC STUDY OF ILLINOIS BEACH STATE PARK, Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2A.
W77-12793

HEAD GRADIENT CONTROL IN AQUIFERS USED FOR FLUID STORAGE, Auburn Univ., Ala. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W77-12800

LAND SUBSIDENCE AND CRACKING DUE TO GROUND-WATER DEPLETION, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. H. Bouwer.
Ground Water, Vol. 15, No. 5, p 358-364, September-October 1977. 6 fig, 3 tab, 15 ref.

Descriptors: *Land subsidence, *Soil mechanics, *Groundwater, *Aquifers, Consolidation, Overdraft, Cracks, Fractures(Geologic), Elastic deformation, Compressibility, Soil physical properties, Theoretical analysis.
Identifiers: Rotating slab theory.

Subsidence of the land surface due to groundwater overdraft is caused by an increase in the intergranular pressure in unconsolidated aquifers and other underground materials. For unconfined aquifers, the increase is the result of a loss of buoyancy of solid particles in the zone dewatered by the falling water table. For confined aquifers, increases in intergranular pressure are caused by decreases in the upward hydraulic pressure against the bottom of the upper confining layer, due to a drop in piezometric surface. Compression of layers in which the intergranular pressure is increased can be calculated with elastic or logarithmic theory. Sample calculations yield rates of subsidence that agree with those observed, i.e., about 5 to 50 cm (2 to 20 inches) per 10-m (33-ft) drop in groundwater level. Groundwater depletion also can produce surface cracks, particularly above discontinuities in bedrock depth along the periphery or in other parts of subsiding basins. Calculations based on the rotating-slab theory showed that the initial surface width of such cracks is about 1 cm (0.5 inch), which agrees with field observations. (Humphreys-ISWS)
W77-12803

INTERFACE BETWEEN TWO DISSIMILAR FLUIDS BENEATH A SHEETPILE COFFERDAM.

Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-12807

HYDROGEOCHEMICAL RELATIONSHIPS USING PARTIAL CORRELATION COEFFICIENTS.

Texas Christian Univ., Fort Worth. Environmental Sciences Program.
D. E. Barr, and L. W. Newland.
Water Resources Bulletin, Vol. 13, No. 4, Paper No. 77073, p 843-846, August 1977. 1 tab, 4 ref.

Descriptors: *Water chemistry, *Groundwater, *Correlation analysis, Ions, Cations, Calcium, Sodium, Magnesium, Chlorides, Sulfates, Data processing, Analytical techniques, Groundwater resources, *Geochemistry.

Identifiers: Partial correlation, Correlation coefficients.

Analyses of 69 groundwater samples were performed for 6 chemical parameters. Partial and simple correlation coefficients for the parameters indicate that partial coefficients are superior to simple coefficients in establishing geochemical relationships for the aqueous system evaluated. The improved reliability arises from the ability of partial correlation analysis to hold constant the outside factors that may be affecting the two variables of interest. (Sims-ISWS)

W77-12808

HYDRODYNAMIC DISPERSION IN UNSATURATED POROUS MEDIA: II. THE STAGNANT ZONE CONCEPT AND THE DISPERSION COEFFICIENT.

For primary bibliographic entry see Field 2G.
W77-12863

WATER PROJECTS GO UNDERGROUND,

Southern California Metropolitan Water District, Los Angeles.

For primary bibliographic entry see Field 4B.

W77-12886

LAW OF GROUND WATER IN PENNSYLVANIA,

Pennsylvania Dept. of Environmental Resources, Harrisburg.

For primary bibliographic entry see Field 4B.

W77-12887

2G. Water In Soils**MODELING SOIL WATER MOVEMENT FOR TRICKLE IRRIGATION - PHASE II,**

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

A. W. Warrick, and D. O. Lomen.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 625, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, August, 1977. 27 p, 13 fig, 4 tab, 34 ref. OWRT B-045-ARIZ(1), 14-34-0001-6056.

Descriptors: *Unsaturated flow, Irrigation, *Soil water movement, *Model studies, Evaporation, Moisture content, Evapotranspiration, Fruit crops, Orchards.

Identifiers: *Trickle irrigation.

This study is a continuation of the previous project (See W76-02365) whose goal was to develop techniques for the solution of the moisture flow equation for conditions of trickle and high-frequency irrigation. Several solutions have been

found for the linearized forms of the moisture equation including flow from a line source above a shallow water table, flow from lines and points with evaporation at the surface and one and two-dimensional flows with plant water uptake. Comparisons of the analytical solutions for the linearizing assumptions were made with finite difference results of the non-linear moisture equation. Results are somewhat encouraging. Conditions favoring the analytical over the numerical solutions are short irrigation cycles, uncertain input data, complex geometries, and expensive computer time. In addition to the mathematical modeling, field measurements were made regarding the microclimate surrounding lemon trees in a trickle-irrigated orchard. Results in June showed evapotranspiration to be on the order of 0.2-0.4 of the open pan evaporation and about three times as large if just the canopy area was considered.

W77-12256

COMPLETION REPORT ON CONTRIBUTION OF FERTILIZERS TO WATER POLLUTION,

Rutgers - The State Univ., New Brunswick, N. J. Dept. of Soils and Crops.

For primary bibliographic entry see Field 5B.

W77-12264

THE PHILIP EQUATION: A FEASIBLE MODEL FOR INFILTRATION ESTIMATION ON SMALL RANGELAND WATERSHEDS,

Utah State Univ., Logan. Coll. of Natural Resources.

R. A. Jaynes, and G. F. Gifford.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 729, Price codes: A07 in paper copy, A01 in microfiche. Utah Center for Water Resources Research, Utah Water Research Laboratory, Logan, October 1977. 149 p, 74 tab, 33 fig, 5 append. OWRT B-143-UTAH(1), 14-34-0001-7193.

Descriptors: *Infiltration, *Range management, *Small watersheds, Sorption, Model studies, Equations, Regression analysis, Land management, Estimating.

Identifiers: *Philip equation.

The objective was to investigate the use of Philip's equation coefficients (which have, in theory, direct physical meaning) to characterize infiltration on rangelands. A least squares regression approach to estimating Philip equation parameters (S and A) essentially reduces both S and A to empirical co-efficients. However, the Philip equation does provide a model that fits infiltrometer data well and reflects significant differences between infiltration curves. The effects of land management and temporal variables (e.g., soil moisture, season) may be associated with changes in S and A for particular sites. Indexing of infiltration curves by model coefficients allows the pooling of infiltrometer data from different researchers and provides a basis for simulation modeling of infiltration and runoff on small watersheds. It is recommended that the Horton equation and other models be tested for further studies of infiltration estimation on rangelands.

W77-12274

SALT SIEVING WITHIN CLAY SOIL AGGREGATES,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Soils.

A. V. Blackmore.

Australian Journal of Soil Research, Vol. 14, No. 2, p 149-158, June, 1976. 4 fig, 2 tab, 11 ref.

Descriptors: *Clays, *Soil aggregates, *Salts, *Pores, *Diffusion, Adsorption, Leaching Gypsum, Sodium chloride, Sodium compounds, Soil types, Ions, Ion exchange, Anions, Flow, Electrolytes.

During mass flow of water through sandy soils, any salt in solution can usually be assumed simply to move along with the water. In clay soils, however, every wet clay surface will, because of negative adsorption, have associated with it a region from which anions are excluded. Consequently, there will always be some tendency for salt to be separated from the water. The rates at which salt diffuses from the stable non-swelling aggregates of a heavy clay soil are studied in relation to both exchangeable cation type and free electrolyte content. Samples of aggregates taken from New South Wales, Australia, were subjected to a regime of diffusion prior to and during which the cation suite on the clay surfaces and the nature and concentration of the salt within the pores and the surrounding water were controlled. The amount of salt remaining in the aggregates was determined as a function of either time or volume of water. Various experiments were conducted and the results presented: the results are broadly consistent with the working hypothesis. (Jamail-Arizona)

W77-12278

EFFECT OF A SALINE AND ALKALINE GROUND WATER ON SOIL GENESIS IN SEMIARID SOUTHERN IRAN,

Pahlavi Univ., Shiraz (Iran). Dept. of Soil Science.

A. Abtahi.

Soil Sciences Society of America Journal, Vol. 41, No. 3, p 583-588, 1977. 7 fig, 4 tab, 35 ref.

Descriptors: *Alkalinity, *Salinity, *Flood Plains, *Soil formation, *Groundwater, Soil Properties, Particle Size, Gypsum, Clays, Calcium, Calcium Compounds, Water Table, Reclamation, Sodium, Calcareous Soils, Dispersion, Leaching, Saline water, Alkaline water, Semiarid climates.

Identifiers: *Iran.

Effects of saline and alkaline groundwater on soil genesis and soil properties were studied on a river flood plain and on a low terrace in southern Iran. Particle size was determined after gypsum and other soluble salts were removed from samples by repeated washing with distilled water. The pH was determined in a saturated soil-water extract. Several tests were conducted and their results are presented, including measurement of the conductivity of the saturation extract. Marked differences in the morphological, physical, chemical and mineralogical properties of soil appear to be due to variations in topography and the depth of saline and alkaline groundwater. (Jamail-Arizona)

W77-12280

USE OF SALT WATERS FOR REDUCING ESP IN HEAVY-TEXTURED ALKALI SOILS,

Ministry of Agriculture, Cairo (Egypt). Soils and Water Research Inst.

For primary bibliographic entry see Field 3C.

W77-12281

RESEARCH ON EFFICIENT WATER USE,

Indian Agricultural Research Inst., New Delhi. Nuclear Research Lab.

R. P. Arora, and J. Bahadur.

Indian Farming, Vol. 26, No. 10, p 37-38, 44, January, 1977.

Descriptors: *Water Utilization, *Water balance, *Nuclear moisture meters, *Isotope studies, *Soil moisture, Soil moisture meters, Moisture meters, Evapotranspiration, Runoff, Water harvesting, Root zone, Arid lands, Radiation, Tritium, Crop production, Deserts, Soil water movement, Groundwater, Instrumentation.

Identifiers: *India(Rajasthan), Desertification, Neutron probe, Gamma scanner.

Work being carried on at the Nuclear Research Laboratory in India to increase water use efficiency is discussed. Experiments utilizing a neutron moisture meter in studies of water use efficiency and water balance are described and the results

Field 2—WATER CYCLE

Group 2G—Water in Soils

presented. Soil moisture movement and ground-water recharge in India are investigated using neutron measuring devices. Irrigation and ground-water use in desert areas of India are discussed. Studies of the efficiency of water use in arid Rajasthan were conducted using isotopes. Results show that groundwater is limited and should be used judiciously. The possibility of using glacial water from the Himalayas is also discussed. The experiments conducted at the Nuclear Research Laboratory are helping India establish suitable agronomic practices to increase crop yields and maximize water use. The information now needs to be translated for use by the Indian farmer. (Jamail-Arizona)
W77-12282

SEASONAL USE OF SOIL WATER BY MATURE VELVET MESQUITE,
Rocky Mountain Forest and Range Experiment Station, Albuquerque, N. Mex.
For primary bibliographic entry see Field 3B.
W77-12283

IRRIGATION OF A SALINE-SODIC SITE IN THE SUDAN GEZIRA. I-WATER MOVEMENT,
Gezira Agricultural Research Station, Wad Medani (Sudan).
For primary bibliographic entry see Field 3C.
W77-12285

IRRIGATION OF A SALINE-SODIC SITE IN THE SUDAN GEZIRA. II-SALT MOVEMENT AND SODICITY CHANGES,
Soil Survey Administration, Wad Medani (Sudan).
For primary bibliographic entry see Field 3C.
W77-12286

SOIL MOISTURE REDISTRIBUTION AS AFFECTED BY THROUGHFALL AND STEM-FLOW IN AN ARID ZONE SHRUB COMMUNITY,
Queensland Dept. of Primary Industries, Charleville (Australia). Charleville Pastoral Lab.
For primary bibliographic entry see Field 2I.
W77-12290

VERTICAL DRAINAGE IN FIELD CORES,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
L. G. Wells, and R. W. Skaggs.
Transactions of the American Society of Agricultural Engineers, Vol. 20, No. 1, p 79-84, January-February 1977. 7 fig, 2 tab, 15 ref.

Descriptors: *Drainage, *Cores, *Laboratory tests, Soil water movement, Soil tests, Mathematical models, Hydraulic conductivity, Soil types, Pressure head, Water table, Irrigation.
Identifiers: Richards equation, Desorption.

In this study, one-dimensional water movement during drainage was examined experimentally using large field cores. The cores were 51 cm in diameter and were considered large enough to incorporate heterogeneities such as worm holes and plant roots, yet small enough to bring into the lab where experimental measurements could be made under controlled conditions. The objective of the study was to evaluate alternate methods of characterizing one-dimensional drainage in natural soils with relatively shallow water tables. (Visocky-ISWS)
W77-12304

EFFECT OF OPENINGS ON INFLOW INTO CORRUGATED DRAINS,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B.
W77-12305

THE DETERMINATION OF TOTAL NITROGEN IN SEDIMENTS USING AN INDUCTION FURNACE,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W77-12313

SOIL WATER MOVEMENT DURING THE FIRST STAGE OF DRYING OF A MOIST, SANDY SOIL UNDER A VERY LOW DRYING RATE,
Tokyo Univ. (Japan). School of Agriculture.
M. Nakano.
Soil Science, Vol 124, No 2, p 67-72, August 1977. 4 fig, 18 ref.

Descriptors: *Soil water movement, *Sands, *Drying, Evaporation, Mathematical models, Equations, Hydraulic gradient, Hydraulic conductivity, Moisture content, Homogeneity, Darcys law, Hydraulic models, Analytical techniques, Humidity.
Identifiers: *Soil columns.

First, here were reported some interesting data of cumulative evaporation observed in the drying process of soil columns without a water table and under a very low drying rate. It is a fact that there is a stage in which the drying rate is remarkably low, after the first stage of drying has finished, i.e., early in the second stage of drying. Second, approximate solutions of the unsaturated liquid water flow equation for the first stage of drying of moist soil have been derived under a constant rate of drying assuming that water movement during the first stage occurs under a total hydraulic head gradient which is not far from zero. Solutions were presented for finite soil columns under the isothermal conditions applying an empirical expression relating water content to tension for limited ranges of water content. The domain of validity of theoretical analysis is characterized by the ratio of drying rate to the unsaturated hydraulic conductivity at the soil surface. When this condition is met, the theoretical water content profiles are in good agreement with the experimental water content distributions. (Visocky-ISWS)
W77-12314

EVAPOTRANSPIRATION AND SOIL WATER MOVEMENT BENEATH THE ROOT ZONE OF IRRIGATED AND NONIRRIGATED MILLET (PANICUM MILLACEUM),
Agricultural Research Service, Florence, S.C.
For primary bibliographic entry see Field 2D.
W77-12315

ERODIBILITY OF SOME MINNESOTA SOILS,
Agricultural Research Service, Morris, Minn.
For primary bibliographic entry see Field 2J.
W77-12317

BACTERIAL AND VIRAL PATHOGENS ASSOCIATED WITH LAND APPLICATION OF ORGANIC WASTES,
Washington State Univ., Pullman. Coll. of Agricultural Research Center.
For primary bibliographic entry see Field 5E.
W77-12445

CONSTITUTION OF SOUTHERN CALCAREOUS CHERNOZEMS DEPENDING ON THEIR DENSITY, (IN RUSSIAN),
Krymskii Selskokhozyaistvennyi Institut, Simferopol (USSR).
V. P. Gordienko.
Pochvovedenie 2, p 69-74, 1976.

Descriptors: *Chernozems, *Calcareous soils, *Soil density, Model studies, Statistics.

A close relationship exists between the capillary and field water capacities on one hand, and the volume weight within 0.9-1.5 g/cm³ on the other. A statistical model of this relationship is presented. Based on these findings and on some agrophysical laws, a mathematical dependence of a series of soil constitution elements on soil density was derived. -Copyright 1976, Biological Abstracts, Inc.
W77-12469

INTERACTION OF CLIMATE, ORGANIC MATERIAL AND STRUCTURAL STABILITY IN MUDDY SOILS, (IN FRENCH),
A. Guckert, and F. Jacquin.
Bull Ec Natl Super Argon Ind Aliment 15(1/2), p 47-67, 1973.

Descriptors: *Climates, *Organic matter, *Muds, *Soil types, Evapotranspiration, Temperature, Distribution patterns, Crops, Acidic soils.

The stability of muddy soils changes in accordance with a yearly cycle, with some notable yearly variations as a function of weather conditions (precipitation, potential evapotranspiration, average monthly temperature). Two highly contrasting years from the meteorologic standpoint suggest the existence of a close parallelism between the evolution of structural stability and climatic data. During the period Sept. 1969-Sept. 1970 the distribution of precipitation coincides with structural fluctuations: a maximal pluviometry corresponds to a maximal Is (index of instability after Henin, 1958) index. When the average monthly temperature rises there is an increase in structural stability, and therefore a diminution in the value of Is. The maintenance of a favorable structure is largely conditioned by the organic matter content. An assay of soil polysaccharides show clear distinctions between soils as a function of pH and type of soil use. Polysaccharides in soils used for pasture are clearly higher than those in crop producing soils and their content goes up in ascending order for acid soil, neutral and alkaline soil. If the soil contains a high proportion of slightly altered organic material (fresh litter, crop residues), the microflora of the soil is stimulated by precipitation at favorable temperatures, with a rapid conversion of organic material.
W77-12470

USE OF THERMODYNAMIC POTENTIAL OF SOIL MOISTURE FOR STUDYING SOIL AND PLANT HYDROPHYSICS, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
N. A. Muromtsev.
Pochvovedenie 3, p 42-52, 1976.

Descriptors: *Soil moisture, Soil-water-plant relationships, Plant physiology, Irrigation.
Identifiers: *Hydrophysics.

The advantages and prospects of the thermodynamic method in studying the energetic state of soil moisture and the main features of moisture movement in the soil-plant-atmosphere system are considered. The thermodynamic method may be successfully used in evaluating and controlling the moisture supply to plants. -Copyright 1976, Biological Abstracts, Inc.
W77-12471

CORRELATION OF SOIL QUALITY UNDER DIFFERENT LEVELS OF AGRICULTURE, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
I. I. Karmanov.
Pochvovedenie 3, p 3-13, 1976.

Descriptors: *Agriculture, Soil analysis, Correlation analysis, *Soil moisture, *Soil texture, *Soil erosion.

Identifiers: *Soil quality.

With the growth of agriculture levels the correlation of quality regularly changes in the main zonal soils in different soil zones, subzones and provinces, and in soils within the same zone and province but different in texture, erodibility and moisture content. Quantitative correlations of qualities of the main zonal soils were considered at low and high levels of agriculture.—Copyright 1976, Biological Abstracts, Inc.
W77-12487

EFFECTS OF IRRIGATION SCHEDULING AND COORDINATED DELIVERY ON IRRIGATION AND DRAINAGE SYSTEMS,
Bureau of Reclamation, Denver, Colo. Lower Colorado Region.
For primary bibliographic entry see Field 3F.
W77-12504

REMOTE SENSING OF SOIL MOISTURE.
Irrigation Journal, Vol. 26, No. 5, p 30-31, September-October 1976. 3 fig.

Descriptors: *Soil moisture, Soil water, *Remote sensing, Irrigation, Temperature.
Identifiers: Irrigation scheduling.

Like physicians taking the temperature and blood pressure of human patients, U.S. Department of Agriculture scientists are testing the temperature and blood, or sap pressure of plants, looking for clues that will indicate under what soil-moisture conditions the plants are growing. (Skogerboe-Colorado State)
W77-12516

SUBTERRANEAN IRRIGATION, A SPECIAL REPORT ON THE PAT, INC. SYSTEM,
For primary bibliographic entry see Field 3F.
W77-12523

SPATIAL VARIATION OF MOISTURE IN PODZOLIC SOILS, (IN RUSSIAN),
I. S. Polyakov.
Pochvovedenie 3, p 65-76. (1976).

Descriptors: *Soil moisture, Model studies, Statistics, *Computer models, *Podzols.

The description of moisture fields by approximating dependencies is possible with sufficiently high precision. Their use may greatly simplify a long-term prediction, especially with the use of statistical models of the locality and the calculation by means of computers. With less precision they may help to obtain data on moisture from adjacent areas.—Copyright 1976, Biological Abstracts, Inc.
W77-12524

HIGH-FREQUENCY TRICKLE IRRIGATION AND ROW SPACING EFFECTS ON YIELD AND QUALITY OF POTATOES,
Agricultural Research Service, Florence, S.C.
For primary bibliographic entry see Field 3F.
W77-12533

TRANSIENT WIND EROSION: A STUDY OF THE NONSTATIONARY EFFECT ON RATE OF WIND EROSION,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2J.
W77-12552

EXPERIMENTAL STUDY AND NUMERICAL SIMULATION OF THE SUBSOIL WATER ENVIRONMENT, (IN FRENCH),
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les Durance (France). Service de Radio-Agronomie.

P. Moutonnet, P. Couchat, and J. Marcesse.
Agric Meteorol 16(2), p 193-209, 1976.

Descriptors: *Soil water, *Soil-water-plant relationships, Simulation analysis, Soil moisture, Tensiometers, Model studies, Climates, Evapotranspiration, Root systems, Soil conductivity.

Through a field-scale study of the use of soil water by roots it is possible to specify certain pedo-climatic criteria defining plant behavior in the soil-plant-atmosphere system. The combined use in the field of a NEMA-10 automatic neutron soil moisture meter and tensiometers gives the values of the following parameters: evapotranspiration (ETR), effective root density (R(z)), hydraulic conductivity of the soil (K(Hv)) and the effect of increased amounts of water. The application of a DIFSOL numerical simulation model allows the results to be interpreted and extended to the case of a hysteretic representation of the K(Hv) curve, or to the data on roots activity drawn from the periodic oscillations of the matrix potential. Following a similar laboratory experiment on altered soil columns, the field study pointed out 2 important differences. With reduced ETR the soil/root competition for water is modified so that the evolution of the water reserves is much more closely related to the hydraulic conductivity of the soil than to the factor of effective root density. Under rainfall or irrigation, simulation of the water profiles observed is possible only if the hysteretic nature of the relation K(Hv) is considered. At 35% Hv, the infiltration and drainage conductivities differ by a factor of 10.—Copyright 1976, Biological Abstracts, Inc.
W77-12572

MISCIBLE DISPLACEMENT IN SOILS,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
A. G. Smajstria, P. L. Barnes, and D. L. Reddell.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 21 p, 8 fig, 1 tab, 6 eq, 8 ref.

Descriptors: *Soil physical properties, Ions, Soil chemistry, *Soil water movement.
Identifiers: Soil hydrologic properties, *Miscible displacement(Soils).

A description of field experimental plots being used to determine soil hydrologic properties and to monitor movement of ions in solution is presented. Steps in the analysis of field data are also itemized, including calculation of soil hydrologic characteristic curves and the calibration procedures required for the instrumentation described. (Skogerboe-Colorado State)
W77-12577

SOLUTIONS TO GREEN-AMPT INFILTRATION EQUATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. L. M. A. Stevens, and D. B. Simons.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE, Vol. 102, No. IR2, p 239-248, June 1976. 1 fig, 1 tab, 14 ref.

Descriptors: *Infiltration, *Soil water movement, Mathematical studies.
Identifiers: *Green-ampt equation, One-dimensional infiltration.

Two simple methods of solving the one-dimensional infiltration equations have been developed. The explicit solution is an approximation obtained by employing a power series expansion of the logarithmic term in the infiltration equation. The maximum error resulting from employing this simple explicit solution is 8%. The implicit 'exact' solution is obtained by refining the explicit solution using the second-order Newton method. The maximum error resulting from employing the im-

plicit solution is 0.03%. These new methods have advantages over other solutions in that they are derived from the theory of power series expansion and the errors due to approximation can be evaluated theoretically. Moreover, the two methods are simple and easy to use either with a desk calculator or in a digital computer, and they are applicable without limitation on ranges. (Skogerboe-Colorado State)
W77-12578

TRANSITION OF CHEMICAL ELEMENTS INTO WATER EXTRACTS FROM SOILS WITH DIFFERENT MINERALOGICAL COMPOSITIONS, (IN RUSSIAN),
Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Institut Pochvovedeniya i Agrokhemii.
I. Sh. Iskenderov.
Pochvovedenie 1, p 133-136, 1976.

Descriptors: *Frozen soils, *Soil treatment, *Soil analysis, Nitrogen, Percolation, Hydrogen sulfide, Mineralogy.
Identifiers: *Soil swelling.

Soil samples of different mineralogical composition were treated in different ways to study the content of water extractable chemical elements. The effect of various methods on swelling and percolating capacity of soils was also studied. The deep freezing of soils with liquid N and the treatment with H2SO4 had a positive effect. The magnetic treatment of soils also had a positive effect. All these treatments appreciably increased the content of Ca, Mg and K, and improved the percolating capacity of soils.—Copyright 1976, Biological Abstracts, Inc.
W77-12579

RUNOFF AND SOIL EROSION ON SLOPES DEPENDING ON CULTIVATED CROPS, (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatel'skii Institut Kukuruzy, Dnepropetrovsk (USSR).
For primary bibliographic entry see Field 2J.
W77-12587

IRRIGATION MANAGEMENT OF SHORT-SEASON, HIGH-DENSITY COTTON,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 3F.
W77-12607

AN AUTOMATIC SYSTEM FOR MEASURING SALT CONCENTRATION PROFILES IN POROUS MEDIA,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
P. L. Barnes, A. Smajstria, and D. L. Reddell.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 14 p, 5 fig, 2 eq, 9 ref.

Descriptors: *Salinity, *Saline soils, *Porous media, *Salts, Measurement.
Identifiers: *Salinity sensor, *Salt concentration profiles.

A low-cost salinity sensor which is easily constructed is described. Also, an electronic circuit which automatically reads and records field and laboratory data from multiple salinity sensors is presented. With this system, salinity data can be collected from several hundred sensors in a short time period. This information can be used to predict and manage real and potential pollution movements in soils. (Skogerboe-Colorado State)
W77-12619

SOIL MOISTURE STATISTICAL PARAMETERS AS A FUNCTION OF SOIL MOISTURE

Field 2—WATER CYCLE

Group 2G—Water In Soils

POTENTIAL AND METHODS OF THEIR DETERMINATION, (IN RUSSIAN), L. I. Varazashvili, I. A. Lytaev, and M. V. Petrova. Pochvovedenie 1, p 66-72, 1976.

Descriptors: *Soil moisture, Statistics, Methodology, Estimating.

It was shown experimentally that with an increase in absolute moisture potential the soil moisture selective variance decreases more slowly than the evaluation of its mathematical expectation. That is why the moisture variation coefficient (pF) presents an inverse function of the moisture. When pF is less than 4.2 moisture variation depends chiefly on the variability of the soil specific surface. For the evaluation of the moisture spatial variation a method is suggested based on the theory of soil moisture thermodynamic potential. The method allows an evaluation of soil moisture statistical parameters with any values of the pF and moisture encountered in nature.—Copyright 1976, Biological Abstracts, Inc.

W77-12713

SOIL SALINITY TESTING IN THE FIELD.

For primary bibliographic entry see Field 7B.
W77-12720

MANAGING SALINE WATER FOR IRRIGATION.

International Center for Arid and Semi-Arid Land Studies, Lubbock, Tex.
For primary bibliographic entry see Field 3C.
W77-12726

CALCULATION AND PREDICTION OF THE SALT REGIME OF LOWLAND SOILS UNDER INFLUENCE OF GROUNDWATER SALINIZATION.

Institut za Vodoprivredu Jaroslav Cerni, Belgrad (Yugoslavia).
N. Plamenac, M. Vikovik, and M. Matic.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 277-289. 9 fig, 5 ref.

Descriptors: *Salinity, *Saline soils, Soil properties, Clays, *Salt balance, Salts, Soil water, River systems, *Groundwater.

The area of lowland alluvial plain along the Danube in the zone of Belgrade is provided with embankments controlling the river floods that results in occurrence of secondary salinization of the soil. Owing to the construction of the 'Djerdap' large hydroelectric power plant, the water level regime in the river is being changed during minimum and medium discharges. This may result in aggravating the groundwater regime and in accelerating the process of soil salinization. In order to realize the rate of salinization in altered conditions and to estimate the influence of various measures, calculation and prediction of the salt regime of lowland soils has been made. The area considered is, in hydraulic view, a two-layer porous medium with clay prevailing in the surface layer. The lower, waterbearing layer, being hydraulically linked with the Danube, consists of sand and gravel. For such hydrogeological conditions a methodology is elaborated for calculation of the groundwater regime, presenting the basis for calculation and prediction of the salt regime of lowland soils in given conditions. (See also W77-12726) (Skogerboe-Colorado State)
W77-12729

RESISTANCE TO SODA SALINIZATION OF SOME IRAQI SOILS.

Baghdad Univ. (Iraq). Coll. of Agriculture.
A. H. Alzubaidi.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 333-338. 2 tab, 10 ref.

Descriptors: *Irrigation water, Soil properties, Calcium, Magnesium, Soil chemistry, Saline water, *Salinity.
Identifiers: *Soda formation, *Iraq(Soils).

In evaluation of irrigation water containing soda, it is not sufficient to determine only the Residual Sodium Carbonate (RSC) according to Eaton. Soil resistance to soda formation values (c-values) which consider the soil properties must also be determined. Soil resistance to soda formation for thirty eight soil samples collected from different locations of Iraq were tested accordingly in this work. The obtained results show that most of these samples have weak to moderate resistance to soda formation. Soil samples with no resistance to soda formation were not noticed. The value of soil resistance to soda formation are determined by the amount of soluble and exchangeable calcium and magnesium in soil samples. According to our findings irrigation water and saline water containing soda could be used under Iraqi conditions for irrigation of some saline soils and during the first stages of their reclamation. The obtained data of this work have a considerable value in evaluation of saline water containing soda for irrigation and reclamation purposes. (See also W77-12726) (Skogerboe-Colorado State)
W77-12730

MODELS FOR PREDICTING THE IMPACT OF IRRIGATION ON SOIL SALINITY.

Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics; and Hebrew Univ., Jerusalem (Israel).
E. Bresler.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 299-315. 7 fig, 13 ref.

Descriptors: *Model studies, *Salinity, Salts, Irrigation, *Irrigation effects, *Saline soils, Simulation analysis, Soil physical properties, Hydraulic conductivity, Soil water, Computer programs, Optimization.
Identifiers: Salt transport(Soils).

Prediction of salinization and sodication for irrigated soils is important in establishing management practice directed toward reclamation of saline soils. Models are used which approximate the physical soil conditions by mathematical expressions describing the simultaneous transport of water and salt. The governing non-linear partial differential equations are supplemented by initial and boundary conditions appropriate to soil salinization and reclamation. (See also W77-12626) (Skogerboe-Colorado State)
W77-12731

CONVECTIVE TRANSPORT OF SOLUTES IN AND BELOW THE ROOT ZONE.

Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 5B.
W77-12732

COMPOSITION OF SALINE DRAINAGE WATER IN IRAQ AND ITS USE.

State Organization of Soils and Land Reclamation, Baghdad, (Iraq).
For primary bibliographic entry see Field 3C.
W77-12740

CHEMICAL RECLAMATION OF SOLONETZ-SOLOCHAKS IN THE ARARAT PLAIN AND THE POSSIBILITY OF UTILIZING SALINE WATERS FOR LEACHING AND IRRIGATION.

Armenian Agricultural Inst., Erevan. Inst. of Soil Science and Agrochemistry.
For primary bibliographic entry see Field 3C.
W77-12743

POTENTIAL FOR SALINE WATER IRRIGATION OF TROPICAL SOILS, Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 3C.
W77-12744

EFFECTS OF IRRIGATION LEACHING MANAGEMENT ON RIVER AND SOIL WATER SALINITY.

Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 3C.
W77-12751

DISTRIBUTION AND SEASONAL VARIABILITY OF MICRONUTRIENTS IN CERTAIN SALT AFFECTED SOILS OF NORTHERN GREECE.

Democritus Nuclear Research Center, Athens (Greece).
For primary bibliographic entry see Field 5B.
W77-12756

MAP OF SALTY SOILS OF AFRICA.

Office de la Recherche Scientifique et Technique Outre-Mer Bondy (France).
G. Aubert.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 598-604, 22 ref.

Descriptors: Salinity, *Saline soils, Salts, *Africa, Mapping, *Maps.

This map is presented as part of the ISSS-UNESCO project, in cooperation with the desertification map project of FAO and UNEP. It has been compiled with the assistance of S.A. Radwanski and G. Murdoch of the Land Resources Division of the United Kingdom, numerous directors of soils programs in African countries, J. Riquier of FAO, and pedologists of ORSTOM. (See also W77-12726) (Skogerboe-Colorado State)
W77-12765

BASIC PRINCIPLES FOR PROGNOSIS AND MONITORING OF SALINITY AND SODICITY.

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
F. I. Massoud.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 432-454, 67 ref.

Descriptors: *Salinity, *Sodium, *Saline soils, Sampling, Salt balance, *Salts, Drainage, *Methodology, Evapotranspiration, Irrigation water, Groundwater, *Forecasting, *Monitoring, Alkaline soils.

The development of a standardized methodology for prognosis and monitoring of salinity and sodicity for application throughout the world may not be easily achieved or appropriate practically where conditions vary from one location to another as is the case in salt affected soils. Moreover, there is usually an element of risk in attempting to transfer the procedures and to over-generalize the use of an established standard methodology without giving enough consideration to local changes or needs. The common tendency to adopt rather than to adapt a methodology quite often gives misleading results and it would be more fruitful and, in this case essential, to go through the rigors of applying the principles. Therefore, knowledge of the basic principles discussed in this paper is an indispensable requirement for the development of local procedures or the adoption of an established methodology. (See also W77-12726) (Skogerboe-Colorado State)
W77-12766

BIOCHEMICAL ACTIVITIES IN A SOIL PROFILE UNDER HARD BEECH FOREST: 2. SOME FACTORS INFLUENCING OXYGEN UPTAKES AND DEHYDROGENASE ACTIVITIES, Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau. D. J. Ross.
N Z J Sci. Vol No 16(2), p 225-240, 1973.

Descriptors: *Soil profiles, Bacteria, Carbohydrate, *Enzymes, Forests, Fungi, Soil moisture, Absorption, Respiration.
Identifiers: *Beech, *Dehydrogenase activity, Glucose, Nothofagus-truncata.

The respiratory activities of different horizons of litter and soil under a hard beech (*Nothofagus truncata*) forest were determined by measuring O₂ uptakes and dehydrogenase activities. Their relationships to other soil properties were assessed. O₂ uptakes mostly declined significantly with increasing sample depth. Separate incubation experiments with O₁ material suggested that uptakes were markedly influenced by contents of water-soluble carbohydrates, and all uptakes responded to added glucose. The uptakes of some horizons differed seasonally, probably influenced by moisture. Uptakes were mostly not related to organic C contents or pH. Dehydrogenase activities appeared to change less with depth. They, too, were generally positively influenced by moisture but also by sample pH. In general, O₂ uptakes were not significantly correlated with dehydrogenase activities, except in samples from the A horizon. Limitations of the dehydrogenase assay procedure may partly explain these results. Both activities appear to have been influenced by numbers of viable bacteria and, in the horizons, by residual plant enzymes. O₂ uptakes may also have been influenced by amounts of fungal hyphae. Both activities were negatively correlated with contents of catechol phenolics. O₂ uptakes and dehydrogenase activities may be influenced to different extents by several factors, with each horizon having its own characteristics. In general, O₂ uptakes appear preferable for estimating general respiratory activity particularly of litter horizons. (See also W77-12778) Copyright 1974, Biological Abstracts, Inc.
W77-12777

BIOCHEMICAL ACTIVITIES IN A SOIL PROFILE UNDER HARD BEECH FOREST: 3. SOME FACTORS INFLUENCING THE ACTIVITIES OF POLYPHENOL-OXIDISING ENZYMES, Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau. D. J. Ross, and B. A. McNeilly.
N Z J Sci. Vol No 16(2), p 241-257, 1973.

Descriptors: *Soil profiles, *Enzymes, Forests, Soil chemical properties, Microorganisms, Metabolism, Fungi.
Identifiers: *Beech forests, Catechol, Nothofagus-truncata.

The occurrence of polyphenol-oxidizing enzymes in litter and soil under hard beech (*Nothofagus truncata*) forest was demonstrated, using catechol and phloroglucinol as substrates, and the presence of o-diphenol oxidases is suggested. Resorcinol-oxidizing activity was not detected. Some of the factors influencing the assay of these enzymes were determined. The catechol-oxidizing activity of litter has a slight optimum about pH 5.5 in a modified Universal buffer but no optimum in 2 others. Phloroglucinol-oxidizing activity increased with pH. These activities were markedly reduced by heat, propylene oxide and sodium azide. Catechol-oxidizing activities were stable on overnight storage at -20°C. Catechol-oxidizing activities varied considerably among samples from each of the horizons but they were usually least in material from the B horizon; in samples from O₁ and A horizons, they were lowest in summer and highest in winter. Generally catechol-oxidizing activities

were not significantly correlated with other enzyme activities, nor could their variations be explained appreciably by a combination of pH, moisture, organic C and total polyphenols. They were, however, correlated negatively and significantly with contents of catechol phenolics. These enzymes appear to have originated mainly from microorganisms, with particular fungi possibly involved, and not from hard beech leaves. The widespread occurrence of these enzymes throughout the soil profile suggests that they may play a significant role in the initial metabolism of phenolic compounds originating from hard beech trees. (See also W77-12777) Copyright 1974, Biological Abstracts, Inc.
W77-12778

THE UNSTEADY GROUNDWATER MOUND BELOW AN IRRIGATION DITCH OR LEAKY CANAL, Agricultural Research Council, Cambridge (England). Unit of Soil Physics. E. G. Young.
Journal of Hydrology, Vol. 34, No. 3/4, p 307-314, August 1977. 3 fig, 6 ref.

Descriptors: *Soil water, *Seepage, *Canals, *Model studies, Laboratory tests, Mathematical models, Irrigation, Groundwater, Soil water movement, Groundwater movement, Water table, Equations, Irrigation ditches, Irrigation canals, Infiltration.
Identifiers: *Groundwater mounds, Hele-Shaw analogue.

The groundwater mound which develops below an irrigation ditch or leaky canal was investigated experimentally using a hydraulic sand-tank model and a Hele-Shaw analogue. The results showed that the mound built up in height at a rate proportional to the cube root of time and moved laterally at a rate proportional to the cube root of the time squared, as predicted from a solution of the Boussinesq equation, obtained numerically after using Barenblatt's transformation. (Sims-ISWS)
W77-12801

NUMERICAL ANALYSIS OF TWO-DIMENSIONAL INFILTRATION AND REDISTRIBUTION, University of New England, Armidale (Australia). School of Natural Resources. S. J. Perrens, and K. K. Watson.
Water Resources Research, Vol. 13, No. 4, p 781-790, August 1977. 6 fig, 36 ref.

Descriptors: *Infiltration, *Soil water, *Soil moisture, *Model studies, Mathematical models, Soils, Soil types, Hysteresis, Hydraulic conductivity, Soil water movement, Pressure, Pressure head, Wetting, Soil physics, Soil science.

The two-dimensional flow equation for the movement of water in unsaturated porous materials was used to study an infiltration-redistribution sequence in which the surface flux is spatially nonuniform. A numerical analysis based on a finite difference scheme involving the use of iterative alternating direction implicit techniques was found to describe the two-dimensional flow process satisfactorily. The program incorporates an interpolation-type hysteresis model which enables temporal as well as spatial variations of flux to be simulated. The flow regime was discussed with reference to two porous materials which have contrasting hydrologic characteristics. The two-dimensional profile distributions of water content and pressure head were represented at significant times by a series of perspective diagrams. (Sims-ISWS)
W77-12806

ATTENUATION OF WASTE WATER ELUTRIATED THROUGH GLACIAL OUTWASH, Wisconsin Univ.-Oshkosh. Dept. of Geology.

For primary bibliographic entry see Field 5D.
W77-12814

ELECTRICAL METHODS OF DETERMINING SOIL MOISTURE CONTENT, Purdue Univ., LaFayette, Ind. Lab. for Applications of Remote Sensing. L. F. Silva, F. V. Schultz, and J. T. Zalusky.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-15532, Price codes: A10 in paper copy, A01 in microfiche. LARS Information Note 112174, 1974. 222 p, 44 fig, 9 tab, 33 ref, 3 append. NASA NGL 15-005-112, NAS9-14016.

Descriptors: *Soil moisture, *Soil moisture meters, *Instrumentation, Electrical properties, Moisture content, Measurement, On-site investigations, Laboratory tests, Model studies, Soils, Soil water, Agriculture.
Identifiers: *Electrical permittivity, Soil permittivity.

Electrical methods of determining soil moisture content were explored. Since the magnetic permeability and electrical conductivity of soils are known to be unreliable indicators of soil moisture content, the report focused on the electrical permittivity of soils. The first part of the report gave an assessment of permittivity as an indicator of soil moisture content, based on experimental studies performed by the authors. The conclusion was that the electrical permittivity of soils is a useful indicator of available soil moisture content. In the second part of the report, two methods of determining the permittivity profile in soils were examined in light of the findings in Part I of this report. A method attributed to Becher was found to be inapplicable to this situation. A method of Slichter, however, appeared to be feasible. The results of Slichter's method were extended to the proposal of an instrument design that could measure available soil moisture profile (percent available soil moisture as a function of depth) from a surface measurement to an expected resolution of 10 to 20 cm. Extension of the results to the airborne remote sensing problem was considered. (Sims-ISWS)
W77-12818

U.S.S.R.: GOLODNAYA (HUNGRY) STEPPE, (CASE STUDY OF DESERTIFICATION), Ministry of Reclamation and Water Management, Moscow (USSR).
For primary bibliographic entry see Field 3C.
W77-12825

NITRATE-N PERCOLATION THROUGH IRRIGATED SANDY SOIL AS AFFECTED BY WATER MANAGEMENT, Agricultural Research Service, Akron, Colo.
For primary bibliographic entry see Field 5B.
W77-12830

SIMULATION OF PHOSPHORUS CYCLING IN SEMIARID GRASSLANDS, Agricultural Research Service, Fort Collins, Colo. Phosphorus Lab. C. V. Cole, G. S. Innis, and J. W. B. Stewart.
Ecology, Vol. 58, No. 1, p 1-15, Winter, 1977. 10 fig, 7 tab, 73 ref.

Descriptors: *Phosphorus, *Model studies, *Grasslands, Semiarid climates, Soil layers, Soil water, Root zones, Organophosphorus compounds, Decomposing organic matter, Colorado, Plant morphology, Abiotic environment, Percolating waters, Grasses, Grama grasses.

The objective was to construct a model to simulate actual flows of phosphorus in a semiarid grassland as closely as possible indicating the constraints and variables which control these processes. A model was developed which had the stability to

Field 2—WATER CYCLE

Group 2G—Water In Soils

operate under a wide range of abiotic and biotic inputs. The model allowed the integration of the effects of moisture, soil properties, plant phenology, and microbial decomposition of organic matter in a manner not possible before. The application of the model to two grassland sites and the comparison of phosphorus flows with actual field measurements pinpointed gaps in information and processes such as mineralization which are not fully researched. The most critical informational needs revealed by model development and operation were in the areas of activity and morphology of roots and the rates of mineralization of organic phosphorus as affected by soil depth. (Jamail-Arizona)
W77-12832

THE HYDRAULIC RESISTANCE OF SUBSURFACE DRAINS AS INFLUENCED BY CERTAIN FILTER MATERIALS,
Ministry of Agriculture, Cairo (Egypt). Soil and Water Research Inst.
For primary bibliographic entry see Field 4A.
W77-12835

HYDRODYNAMIC DISPERSION IN UNSATURATED POROUS MEDIA: II. THE STAGNANT ZONE CONCEPT AND THE DISPERSION COEFFICIENT,
R. Gupta, R. J. Millington, and A. Klute.
J Indian Soc Soil Sci. Vol. 21, No. 2, p 121-128, 1973.

Descriptors: *Dispersion, *Porous media, Hydrodynamics, Tracers, *Seepage, Measurement.

Dispersion coefficients, calculated from observed concentration vs. time profiles along the length of a glass bead pack, increased with distance from the plane of tracer introduction. The dispersion coefficients were of the order of 10^{-4} - 10^{-3} cm²/sec for a range of seepage velocities (0.0168-0.14 cm/min) and solution contents (0.21-0.37 cm³/cm³). The dispersion coefficient increased with increasing seepage velocity and in most cases, with decreasing solution content. The seepage velocity and solution content were varied independently. (See also W77-02529)—Copyright 1974, Biological Abstracts, Inc.
W77-12863

STUDIES ON THE TUNGABHADRA CATCHMENT SOILS: II. PHYSICOCHEMICAL PROPERTIES AND SOIL TAXONOMY,
Central Soil Salinity Research Inst., Karnal (India).
G. P. Bhargava, N. R. Datta Biswas, and S. V. Govinda Rajan.
J Indian Soc Soil Sci. 21(2), p 193-203, 1973.

Descriptors: *Soil physical properties, Soil types, Soil texture, Magnesium.
Identifiers: Alfisols, Gneiss, Granite, Hematite, Inceptisols, Quartzite, *Tungabhadra (India).

The processes of eluviation and illuviation contribute little in the development of these soils. The basic schistic rocks with their readily weatherable ferromanganese minerals gave rise to heavy textured smectitic soils in an atmosphere saturated with divalent cations. The soils derived from granite-gneiss and banded hematite quartzite are coarse textured and illitic in nature. The alluvial and black soils could be classified as inceptisols whereas the red soils represented alfisols. —Copyright 1974, Biological Abstracts, Inc.
W77-12879

HYDROTHERMAL STATE OF PEAT-BOGGY SOILS IN THE EXTREME NORTH, (IN RUSSIAN),
Akademiy Nauk SSSR, Kirov. Polyarno-Alpiiskii Botanicheskii Sad.
A. P. Semko.

Pochvovedenie 3, p 77-87, 1976.

Descriptors: *Peats, *Bogs, Soils, Cultivation, *Soil water, Porosity.
Identifiers: USSR.

Under the effect of cultivation, the volume and specific weights increase and the porosity and water capacity decrease. Cultivation decreases moisture content and degrades the temperature regime of the soils. The cultivated peat-boggy soils freeze through considerably deeper and thaw out later than virgin soils. In dry years plants do not suffer from the lack of water on peaty soils as on mineral soils.—Copyright 1976, Biological Abstracts, Inc.
W77-12890

EFFECTS OF THE COARSE CONSTITUENTS ON WATER FLOW IN A SANDY SOIL, (IN FRENCH),
Centre de Recherches Agronomiques de Provence, Antibes (France). Station d'Agronomie et de Physiologie Vegetale.
R. Gras.
Bull Assoc Fr Etude Sol. 3, p 155-164, 1974.

Descriptors: *Soil water, *Sands, Hydraulic conductivity, Porosity, Moisture content.

The speed of the wet front increases when it runs near the coarse constituents which reduce the hydraulic conductivity of the system. When the coarse constituents are porous the wet front speed depends on the reduction of the sand volume to be moistened, which tends to increase speed, and on the reduction of the available water, the effect of which reduces speed. Coarse constituents are moistened much faster as pores are narrower; and the water moves faster.—Copyright 1975, Biological Abstracts, Inc.
W77-12896

CONDITIONS OF THE EMERGENCE OF SOIL TOXICITY DURING APPLICATION OF STRAW AND FLOODING, (IN RUSSIAN),
Moskovskaya Sel'skokhozyaistvennaya Akademiya (USSR). Div. of Microbiology.
O. D. Sidorenko.
Izv Timiryazev S-Kh Akad 1, p 117-123, 1977.

Descriptors: *Flooding, *Straw, Soils, *Toxicity, *Microbial degradation, Oxidation reduction potential, Organic compounds.
Identifiers: *Soil toxicity.

The application of fresh straw into flooded soil favorably affects rice yield and causes a change of biological activity of the soil and redox conditions. At the beginning of straw decomposition the growth of plants is retarded, which is likely to be associated with the presence of certain organic compounds in the straw, the conditions of its decomposition and the change of the microbial associations.—Copyright 1977, Biological Abstracts, Inc.
W77-12893

DETERMINATION OF OPTIMAL SOIL MOISTURE CONDITIONS FOR GRASS STANDS IN THE DRY VALLEYS OF THE MOSCOW OBLAST (USSR), (IN RUSSIAN),
Moskovskaya Sel'skokhozyaistvennaya Akademiya (USSR). Div. of Meadow Science.
V. A. Tyul'dyukov, and A. D. Prudnikov.
Izv Timiryazev S-Kh Akad 6, p 34-45, 1976.

Descriptors: *Soil moisture, *Grasses, Nitrogen, Phosphorus, Potassium, Moisture content, *Fertilizers, Fertilization, Valleys.
Identifiers: *USSR (Moscow Oblast valleys).

The best conditions for establishing pasture grass stand are created when soil moisture is not lower than 70% of the next maximum field water capaci-

ty. Under such conditions the best rate of fertilizers is N240 P180K180.—Copyright 1977, Biological Abstracts, Inc.
W77-12995

SOIL MOISTURE RETENTION OF SOIL PROFILES, (IN HUNGARIAN),
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
G. Kovacs, and P. Tibor.
Agrokem Talajtan 24(1/2), p 99-120, 1975.

Descriptors: *Soil moisture, Retention, *Soil profiles, Saturated soils, Moisture content, *Distribution, Probability.

The forces influencing soil moisture in the saturated and intermediate zones, the conditions of their balanced state and the vertical moisture distribution of a soil profile influenced by these balanced forces are discussed. The whole moisture curve (pF curve) is composed of 2 parts, the hyperbole for the unsaturated zone and the probability distribution function in the transition zone. Two distribution curves which encircle the possible zone of hysteresis must be determined. In the open capillary zone the superposition of the hyperbole and the relevant distribution curve must be considered.—Copyright 1977, Biological Abstracts, Inc.
W77-12997

THE USE OF CALIBRATED PAPER FILTERS FOR MEASURING TO TOTAL SOIL MOISTURE POTENTIAL, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science.
V. Kryuger, and I. I. Sudnitsyn.
Vestn Mosk Univ Ser Vi Biol Pochvoved 31(3), p 125-128, 1976.

Descriptors: *Filters, *Measurement, *Soil moisture, *Moisture content, Water pressure, Calibration, Permeability.

There is a stable logarithmic relationship between filter-paper moisture-content and total water potential (pressure). Due to this relationship it is possible to measure the total soil moisture pressure with calibrated filter-paper. An equilibrium is attained in 2 days without contact between paper and soil in a constant-temperature condition. Under nonconstant-temperature conditions measurements are possible in soils covered with an impermeable film.—Copyright 1977, Biological Abstracts, Inc.
W77-12998

EXPERIMENTAL EQUIPMENT FOR STUDYING SOIL EROSION RESISTANCE AND SOME RESULTS OF ITS APPLICATION, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science.
V. Ya. Grigor'ev, and M. S. Kuznetsov.
Vestn Mosk Univ Ser Vi Biol Pochvoved 31(3), p 129-134, 1976.

Descriptors: *Soil erosion, *Methodology, Equipment, *Loams, *Sierozems.

Experimental equipment and methods for determining scouring velocities in the field are described. Comparative study of loam light sierosem both in the field and laboratory showed that scouring velocities as determined in the field are lower than those determined in laboratory.—Copyright 1977, Biological Abstracts, Inc.
W77-12999

ENZYMATIC ACTIVITY OF GRAY FOREST SOILS, (IN RUSSIAN),
V. M. Alifanov, R. P. Lichko, N. A. Loshakova, and V. I. Steputina.
Pochvovedenie 11, p 127-132, 1976.

Descriptors: *Enzymes, *Soil erosion, *Clays, *Forest soils, *Humus, Respiration, *Fermentation.
Identifiers: *Enzymatic activity(Soils).

The determination of grey forest soil fermentative activity as an additional diagnostic criteria of soil erodibility is considered. The invertase activity and soil respiration must be regarded as additional features to the main diagnostic criteria of soil erodibility, humus and clay fraction contents.—Copyright 1977, Biological Abstracts, Inc.
W77-12000

2H. Lakes

LAND AND RECREATIONAL DEVELOPMENT AT NEW JERSEY RESERVOIRS,
Rutgers - The State Univ., New Brunswick, N.J.
Dept. of Environmental Science.
For primary bibliographic entry see Field 6G.
W77-12257

AQUATIC NATURAL AREAS IN IDAHO,
Idaho Univ., Moscow. Dept. of Biological Sciences.
For primary bibliographic entry see Field 4A.
W77-12269

ATMOSPHERIC ENHANCEMENT OF METAL DEPOSITION IN ADIRONDACK LAKE SEDIMENTS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 5A.
W77-12270

THE CONTRIBUTION OF RED CLAY EROSION TO ORTHOPHOSPHATE LOADINGS INTO SOUTHWESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W77-12307

BIOGENIC MEROMIXIS AND STABILITY IN A SOFT-WATER LAKE,
Washington Univ., Seattle. Dept. of Zoology.
D. A. Culver.
Limnology and Oceanography, Vol 22, No 4, p 667-686, July 1977. 15 fig, 6 tab, 20 ref. AEC AT-(45-1)-2225-T23.

Descriptors: *Meromixis, *Stability, *Lakes, *Washington, *Biological properties, On-site investigations, Water temperature, Seasonal, Heat transfer, Water chemistry, Nutrients, Oxygen, Chlorophyll, Biota, Sediments, Mixing, Limnology.
Identifiers: *Hall Lake(Wash), *Holomixis.

Hall Lake, Washington, was studied during a period of meromixis (1950-1953) and during a period of holomixis (1968-1972). Comparisons of thermal cycles, light penetration, chemical distribution, and productivity indicated that the lake had a greater productivity while meromictic, even though the seasonal accumulation of dissolved materials in the deep waters was greater during the holomictic period. Calculations showed that the stability due to chemical stratification was actually greater during the homomictic period, supporting the idea that in biogenic meromictic lakes, circulation may be controlled more by thermal phenomena than by chemical stratification. Turbid inflows during winter tended to destroy meromixis, but low transparencies due to algal blooms in summer tended to encourage it and may be the primary way by which biogenic meromictic lakes become permanently stratified. (Sims-ISWS)
W77-12319

THE MAJOR PLANT FORMATIONS OF THE IZHEVSK RESERVOIR AND THEIR PRODUCTIVITY, (IN RUSSIAN),
Izhevsk Agricultural Inst. (USSR).
T. A. Varfolomeeva.
Bot Zh (Leningr) 61(6), p 896-900, 1976.

Descriptors: *Productivity, Reservoirs, Aquatic plants, Topography, *Distribution, Depth.
Identifiers: *USSR(Izhevsk Reservoir).

Short descriptions are given of the 20 major plant formations, 51 associations and 27 spp. which produce a strong overgrowth in the Izhevsk reservoir (USSR). Data is given on the productivity in damp and air-dried weight in centners/ha for 6 ecological groups (Equiseteta (fluvialis); Phragmiteta (communis) - Typheta (ar.gustifoliae) - Schoenoplecteta (lacustris); Nuphareta (lutei) - Polygoneta (amphibiae) - Potamogetoneta (natantis); potamogetoneta (lucentis) - Potamogetoneta (perfoliati) - Potamogetoneta (pectinati) - Elodeeta (canadensis) - Hippurideta (vulgaris); Ceratophylleta (demers); Stratioteta (aloidis) - Lemneta (minoris) spirodeleta) comprising 15 formations. The distribution of plants in reservoirs depends to a significant degree on topographical features such as the nature of bank lines and depths.—Copyright 1977, Biological Abstracts, Inc.
W77-12325

SAGINAW BAY WATER CIRCULATION,
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
L. J. Danek, and J. H. Saylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 075. Price codes: A04 in paper copy, A01 in microfiche. Report NOAA TR ERL 359-GLERL 6, December 1975. 55 p, 11 fig, 1 tab, 9 ref, 3 append. EPA-IAG-D4-0502.

Descriptors: *Bays, *Water circulation, *Winds, *Lake Huron, Current meters, Histograms, Lakes, Circulation, Seiches, Wind velocity, Coriolis force, Buoys, Flow.
Identifiers: *Saginaw Bay, *Saginaw River, *Windward drift, Power spectra, Circulation patterns, Wind stress, Dynamic height method, Ground truth.

A combination of Lagrangian measurements and fixed current meter moorings during the summer of 1974 was used to determine the circulation patterns of Saginaw Bay. Distinct circulation patterns were determined for a southwest wind and for a northeast wind. Speeds measured in the inner bay were on the order of 7 cm/s, whereas in the outer bay the speeds averaged closer to 11 cm/s. A typical exchange rate between the inner and outer bay was 3700 cu m/s for winds parallel to the axis of the bay, but winds perpendicular to the axis of the bay caused little water to be exchanged. The driving forces that control the circulation patterns in the bay also were examined. The water motions in the inner bay are driven almost solely by wind stress, whereas the outer bay is influenced also by the circulation of Lake Huron and by the geometry of the area. Inertial oscillations are the most dominant periodic component of the flow. Seiche motions of Lake Huron and the bay itself were detected, but they were of little importance in determining gross circulation of the bay. (Roberts-ISWS)
W77-12326

DISTRIBUTION AND ECOLOGICAL SIGNIFICANCE OF VITAMIN B12 AND THIAMIN IN THREE LAKES, (IN FRENCH),
Institut National de la Recherche Agronomique, Thonon-les-Bains (France). Station d'Hydrobiologie Lacustre.
B. Pommel.
Ann Hydrobiol 6(2), p 103-121, 1975.

Descriptors: Vitamin B, *Vitamins, *Distribution, Ecology, Lakes, *Growth rates, Seasonal, Phytoplankton.
Identifiers: Aphanizomenon-flos-aquae, Euglena-gracilis, Lactobacillus-fermentii, Oscillatoria-redekei, Oscillatoria-rubescens, *Thiamin, *Vitamin B12.

Many phytoplanktonic species require a particular vitamin in their environment if they are to grow. Monthly tests of vitamin B and thiamin were undertaken in Nantua, Leman and Annecy Lakes (France) in order to ascertain the ecological significance of these compounds. Test organisms were Euglena gracilis for vitamin B12 tests and Lactobacillus fermenti for thiamin tests. In Nantua and Leman Lakes, a decrease in contents of vitamin B12 and macronutrients in the superficial waters was observed together with the springtime algal growth. Vertical distribution of vitamin B12 in Nantua lake during spring is the same as dissolved inorganic P distribution and inverse to Oscillatoria rubescens distribution. In summer, great growths of O. redekei and Aphanizomenon flos-aquae increase the vitamin content of epilimnion. O. redekei and A. flos-aquae may produce vitamin B12 while O. rubescens may consume it, at least in spring.—Copyright 1977, Biological Abstracts, Inc.
W77-12334

LIMNOLOGICAL STUDIES ON THE THREE DAMMED LAKES, CONSTRUCTED IN THE WATERCOURSE OF THE MONOBE RIVER, KOCHI PREFECTURE, (IN JAPANESE),
For primary bibliographic entry see Field 5C.
W77-12364

ECOLOGY OF ENCRUSTING MICROFAUNA OF HIGHER AQUATIC PLANTS OF THE KIEV RESERVOIR, (IN RUSSIAN),
Akademiya Nauk USSR, Kiev. Institut Hidrobiologii.
M. N. Dekhtyar.
Gidrobiol Zh 12(3), p 18-22, 1976.

Descriptors: Ecology, *Microorganisms, Aquatic plants, Reservoirs, *Crustaceans, *Nematoda, Vegetation, Aquatic animals.
Identifiers: *Testacea, Ukrainian-SSR, *USSR(Kiev Reservoir).

A brief description is presented of the distribution of the main taxonomic groups composing the encrusting microfauna (Testacea, Nematoda, Crustacea) on higher aquatic plants. Distribution in the reservoir (Ukrainian SSR, USSR) and level of quantitative development of microzoophytosis are dependent on determining factors such as flowage of shallow waters, position on the floodplain and type of vegetation.—Copyright 1977, Biological Abstracts, Inc.
W77-12365

PLANKTONIC INFUSORIA FROM THE VOLGA RIVER, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
N. V. Mamaeva.
Gidrobiol Zh 11(1), p 33-38, 1975.

Descriptors: *Plankton, Reservoirs, Rivers, Biomass.
Identifiers: Codonella-cratera, Coleps-hirtus, *Infusoria(Planktonic), Mesodinium-pulex, Phaseolodon-vorticella, Stokesia-vernalis, Strobilidium-velox, Strobilidium-viride, Tintinnidium-fluviatile, Tintinnopsis-cylindrata, *USSR(Volga River), *Saprobility.

In the section of the Volga river between Kalinin and Astrakhan (Russian SFSR, USSR) 80 Infusoria species were found, 9 of which (Tintinnidium fluviatile, Codonella cratera, Strobilidium velox, Stokesia vernalis, Strobilidium

Field 2—WATER CYCLE

Group 2H—Lakes

viride, Mesodinium pulex, Coleps hirtus, Tintinnopsis cylindrata, Phaseolodon vorticella) were widely distributed. The maximum number and biomass (to 4 million/m³ and 2.6 g/m³ were observed in spring in the Ivankov reservoir. The Ivankov reservoir and the Volga river sections were distinguished for the greatest species diversity, the Gorky and Saratov reservoirs by the least. The Volga in its bed part may be referred to beta-mesosaprobic water bodies, the areas of increased saprobility being present.—Copyright 1977, Biological Abstracts, Inc.
W77-12397

PRODUCTION LEVEL OF THE AMPHIPODS PONTOGAMMARUS MAEOTICUS (SOW.) AND P. CRASSUS (G.O. SARS) IN THE RESERVOIRS OF THE DNIEPER, (IN RUSSIAN), Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.
T. V. Koval'chuk.
Gidrobiol Zh 12(3), p 70-73, 1976.

Descriptors: *Productivity, Reservoirs, *Amphipoda, Biomass, Aquatic plants.
Identifiers: *Pontogammarus crassus, *Pontogammarus maeoticus, *USSR(Kakovka Reservoir), Dnieper River, *USSR(Kiev Reservoir).

P. maeoticus production in the Kakhovka Reservoir (USSR) was studied from April-Oct. 1968-1969, and P. crassus production was studied in the Kiev Reservoir from April-Oct. 1969-1970. During the period of study, the production level was 1675.488 g/sq m for P. maeoticus and 130.366 g/kg dry weight plant material for P. crassus, while the production/biomass coefficients for the 2 spp. were 5.544 and 12.480, respectively. Maximum production for P. maeoticus was observed in June-Oct, and the maximum production/biomass coefficient (3.675) was noted in June-Aug. P. crassus showed maximum production in May-Sept. and a maximum production/biomass coefficient (9.735) in May-Aug.—Copyright 1977, Biological Abstracts, Inc.
W77-12415

CHANGES IN THE VERTICAL DISTRIBUTION OF THE PLANKTONIC CRUSTACEA IN LAKE TAZENAT AND LAKE PAVIN (MASSIF CENTRAL, FRANCE) DURING THE YEAR, (IN FRENCH), Biological Station, Besse-en-Chandesse (France). N. Lair, M. P. Charuau, and J. L. Berthon.
Ann Stn Biol Besse-En-Chandesse 9, p 25-58, 1974/1975.

Descriptors: *Spatial distribution, Plankton, Sampling, *Crustaceans, Lakes, Daphnia, Annual, *Trophic level, *Light, Water temperature.
Identifiers: Acanthodiptomus-Denticornis, Cyclops-Abyssorum-Prealpinus, Daphnia-Longispina, *France, Tazenat, Lake Tazenat, Lake Pavin.

Samples were taken twice a month for 1 yr with a plankton net hauled from the bottom to the surface, and with a pump at the surface, 4,7,10,15, and 20 m (depth). A coefficient of correction was applied by making comparisons with standard samples taken with a Van Dorn bottle. Temperature is apparently the determining factor for the vertical distribution of Acanthodiptomus denticornis. The distribution of Cyclops abyssorum prealpinus and Daphnia longispina is determined by trophic conditions and light. Different developmental stages are not generally isolated at different levels; those stages with the same physiological requirements and the same food needs are associated.—Copyright 1977, Biological Abstracts, Inc.
W77-12468

OBSERVATIONS OF BARRED COASTAL PROFILES UNDER THE INFLUENCE OF RISING WATER LEVELS, EASTERN LAKE MICHIGAN, 1967-71, Coastal Engineering Research Center, Fort Belvoir, Va. E. B. Hands.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A023191, Price codes: A06 in paper copy, A01 in microfiche. Technical Report 76-1, January 1976. 113 p, 54 fig, 9 tab, 102 ref, 2 appendix.

Descriptors: *Coastal engineering, *Sand bars, *Shores, *Erosion, *Waves(Water), *Lake Michigan, Shore protection, Sand waves, On-site investigations, Measurement, Profiles.
Identifiers: *Longshore bars, *Pentwater Harbor, Coastal profiles.

Described in the report were the lakeshore bathymetry and its temporal variations over a 4-year period covering 50 km of shore near Pentwater Harbor on the eastern shore of Lake Michigan. A sequence of four, well developed, straight longshore bars paralleled the shore. The bars were observed to merge with one another only twice along the entire 50 km and were persistent year-round features. In wavelength, lacustrine longshore bars overlap with the sand waves from continental shelves. In relief the bars were somewhat smaller. The upper limit on the cross-sectional area of a given bar was numerically about the same as the spacing between it and the next bar shoreward. Waves were observed to break almost exclusively by spilling. Inner bars north of Pentwater Harbor rose 0.5 m and migrated an average of 26 m landward. The shoreline retreated at a rate that averaged 4 m per year. Landward migration of longshore bars exceeded shoreline retreat by 75%. (Bhowmik-ISIS)
W77-12540

A PRIMER OF BASIC CONCEPTS OF LAKESHORE PROCESSES, Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2J.
W77-12545

GEOHERMAL GRADIENTS IN BRITISH LAKE SEDIMENTS, Institute of Oceanographic Sciences, Merseyside (England). Bidston Observatory.
For primary bibliographic entry see Field 2J.
W77-12558

SURF OBSERVATIONS AND LONGSHORE CURRENT PREDICTION, Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.
W77-12560

DESIGN WAVE INFORMATION FOR THE GREAT LAKES; REPORT 2, LAKE ONTARIO, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W77-12569

THE BIOLOGY OF DAPHNIA MAGNA STRAUS AND THE PRODUCTION OF ITS POPULATION IN LAKE BUGAEVO (KRASNOYARSK KRAI), (IN RUSSIAN), Siberian Research Inst. of the Fish Industry, Krasnoyarsk (USSR). Krasnoyarsk Div. T. Ya Pushchaeva.
Gidrobiol Zh 12(1), p 105-108, 1976.

Descriptors: *Daphnia, Zooplankton, Biomass, Lakes, *Productivity, *Growth rates, *Fish foods.

Identifiers: Daphnia-magna, Krasnoyarsk Krai, Russian-Sfsr, *USSR(Lake Bugaevo).

In order to facilitate the rational use of artificial water bodies as a food base for fish, the D. magna population was studied in Lake Bugaevo, (Krasnoyarsk Krai (Russian SFSR, USSR)) where it comprises 88% of the zooplankton biomass and is the major source of food for fish. The average life span of the water fleas was 42 days and average fertility was 156 eggs. The maximum absolute growth accretion (0.105 mg/day) occurred approximately in the middle of the life span (20th-22nd day) and the specific daily growth of the population was 0.2-0.4. The average production/biomass coefficient for May 13-Aug 24 of 1972-1973 was 27.4.—Copyright 1976, Biological Abstracts, Inc.
W77-12616

STUDIES ON PLOVER COVE RESERVOIR, HONG KONG III. A COMPARISON OF THE SPECIES COMPOSITION OF DIATOM FLORAS ON DIFFERENT SUBSTRATES, AND THE EFFECTS OF ENVIRONMENTAL FACTORS ON THEIR GROWTH, Hong Kong Univ. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-12783

STUDIES ON LAKE POWELL, USA: ENVIRONMENTAL FACTORS INFLUENCING PHYTOPLANKTON SUCCESS IN A HIGH DESERT WARM MONOMICTIC LAKE, Northern Arizona Univ., Flagstaff. Dept. of Biological Sciences. A. J. Stewart, and D. W. Blinn.
Archiv fuer hydrobiologie, Vol. 78, No. 2, p 139-164, 1976. 15 fig, 5 tab, 23 ref.

Descriptors: *Lakes, *Phytoplankton, *Algae, *Water temperature, *Thermal stratification, Diatoms, Arizona, Reservoirs, Aquatic plants, Environmental effects, Limiting factors, Succession.
Identifiers: *Lake Powell(Ariz), Monomictic lakes.

Limnological investigations at three stations in Warm Creek Bay of Lake Powell, Arizona were concerned with physical, chemical, and biological differences in algal communities due to differences in depth or proximity to shore. At the two deepest stations thermal stratification in summer leads to a zone of oxygen depletion below 15 meters. The shallowest station does not stratify. Twenty dominant algal species generally account for 85 percent or more of the total number of individuals in any sample. Seasonal algal succession followed a pattern typical of moderate-sized temperate lakes, with a spring diatom pulse, diverse phytoplankton community in the summer, increase in diatom populations in late autumn, and a significant reduction in diatom numbers in the winter. Water temperature is an important parameter in regulating phytoplankton density. (Frondorf-Arizona)
W77-12833

ELEMENTS IN AQUATIC MACROPHYTES, WATER, PLANKTON, AND SEDIMENTS SURVEYED IN THREE NORTH ISLAND LAKES, Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 5B.
W77-12860

PLUTONIUM IN THE LAURENTIAN GREAT LAKES: FOOD-CHAIN RELATIONSHIPS, Bureau of Sport Fisheries and Wildlife, Washington, D. C.
For primary bibliographic entry see Field 5B.
W77-12862

SECOND REPORT OF THE SPECIAL MASTER IN THE CASE OF UTAH V UNITED STATES (CONCERNING BOUNDARIES OF INLAND BODIES OF WATER AND THE NATURE OF MEANDER LINES).

For primary bibliographic entry see Field 6E.
W77-12895

ECOLOGY OF THE AMPHIPOD PONTOGAMMARUS CRASSUS (G. O. SARS) IN THE KIEV RESERVOIR, (IN RUSSIAN),

Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.
T. V. Koval'chuk.

Gidrobiol Zh. 10(3), p 82-84, 1974.

Descriptors: *Amphipoda, *Crustaceans, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Reservoirs, Aquatic plants, Submerged vegetation stage, *Ecology.
Identifiers: Pondweed, *Pontogammarus-crassus, *USSR(Kiev Reservoir).

In the Kiev Reservoir (USSR) *P. crassus* colonizes submerged high aquatic vegetation, giving preference to perfoliate pondweed and Cladophora. A water temperature of 18-22°C, dissolved O₂ in the water of 6.7-9.25 mg/l and a pH 7.4-8.7 are favorable for the species. *P. crassus* appears on plants in early spring when the water temperature is 13.5-15.8°C. Maximum abundance is reached by late Aug.-early Sept. In the fall *P. crassus* moves into coves where it winters. —Copyright 1975, Biological Abstracts, Inc.
W77-12930

PREDICTION OF LITTORAL DRIFT FOR LAKES AND BAYS FROM WIND OBSERVATIONS,

Florida Univ., Gainesville. Dept. of Civil Engineering; and Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2J.
W77-12958

ENVIRONMENTAL IMPACT ON PROPERTY VALUES ALONG NEW YORK'S LAKE ERIE COASTLINE,

New York Sea Grant Inst., Albany.
For primary bibliographic entry see Field 5G.
W77-12960

EFFECTS OF CONTINUOUS ENRICHMENT WITH NITRATES ON POPULATIONS OF DIATOMS ISOLATED WITH THE AID OF ENCLOSURES IN AN OLIGOTROPHIC POND, (IN FRENCH),

Rennes Univ. (France). Hydrobiological Lab.
For primary bibliographic entry see Field 5C.
W77-12972

STUDIES OF THE CAUSES OF FISH MORTALITY IN LAKE BALATON IN 1975, (IN HUNGARIAN),

Mem. Novenyvedelmi Kozpont (Hungary). Vizelettani Lab.
For primary bibliographic entry see Field 5B.
W77-12981

THE LAW OF PROBABILITY DISTRIBUTION FOR THE ZOOPLANKTON BIOMASS IN LAKE BAIKAL, (IN RUSSIAN),

Irkutskii Gosudarstvennyi Universitet (USSR). Scientific Research Inst. of Biology.
N. G. Mel'nik, G. I. Pomakhova, L. I. Kalyuzhnaya, and M. M. Andreev.
Gidrobiol Zh. 12(4), p 78-82, 1976.

Descriptors: *Zooplankton, *Biomass, Lakes, *Distribution, *Probability, Mathematical models.
Identifiers: *Lake Baikal(USSR).

A histogram of the distribution of the average monthly zooplankton biomass in Lake Baikal (USSR) (in the 0-250 m layer, 1.5-2 km from shore) for the period 1946-1970 was constructed, along with theoretical and empirical probability distribution curves. Comparison of the 2 curves indicated that Pearson's curve of the 3rd type may be used to determine the frequencies of different biomass values. —Copyright 1977, Biological Abstracts, Inc.
W77-12984

THE EFFECT OF ALGAL FOOD ON THE GROWTH, FERTILITY AND LIFE SPAN OF BOSMINA LONGIROSTRIS (O.F. MULLER), (IN RUSSIAN),

Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.
G. A. Zhdanova, and T. V. Frimovskaya.
Gidrobiol Zh. 12(4), p 82-86, 1976.

Descriptors: *Phytoplankton, *Algae, *Fish food organisms, Growth rates, *Scenedesmus, *Chlorella, Reservoirs.
Identifiers: *Bosmina longirostris, Scenedesmus obliquus, Ukrainian SSR, *USSR(Kiev Reservoir).

Studies with *B. longirostris* fed various concentrations of *Scenedesmus obliquus* or *Chlorella* sp. indicated that linear growth was independent of food concentration, while the amount of food consumed was directly proportional to weight. Fertility and life span were also affected by food concentration. On the basis of food consumption data, the role of *B. longirostris* in the consumption of phytoplankton in the Kiev Reservoir (Ukrainian SSR, USSR) can be evaluated. —Copyright 1977, Biological Abstracts, Inc.
W77-12985

SEASONAL DEVELOPMENT OF SEVERAL BIOMASS INDICATORS IN THE WATERS OF LAKE BERRE AND THEIR RELATIONSHIPS, (IN FRENCH),

Centre Universitaire de Luminy, Marseille (France). Lab. of Prod. Pelagique.
M. Minas.
Tethys 7(2/3), p 115-130, 1975 (1976).

Descriptors: *Biomass, *Bioindicators, Lakes, *Seasonal, *Primary productivity, Carbon, Seston, Carbonates, Measurement.
Identifiers: Carbon-14, *France, *Lake Berre, *Organic carbon.

Several biomass indicators were studied in Lake Berre waters at 2 stations, during 1 yr. together with primary production measurements by the 14C method. By the study of relationships between these parameters, a valuable organic C value estimation was obtained, in seston containing a high carbonate fraction. —Copyright 1977, Biological Abstracts, Inc.
W77-12986

RESULTS OF FRESHWATER STUDIES IN THE INTERNATIONAL BIOLOGICAL PROGRAM: LIMNOLOGICAL RESEARCH IN JAPAN, (IN RUSSIAN),

G. G. Vinberg.
Gidrobiol Zh. 12(4), p 105-117, 1976.

Descriptors: *Limnology, *Research and development, *Biology, Lakes, Ponds, Rivers, *Biomass, Productivity, Microorganisms, Carp, Aquatic plants.
Identifiers: Goldfish, *Japan.

Some of the major results of freshwater studies conducted in Japan as part of the International Biological Program are reviewed. Conducted on 5 lakes (Biwa, Yunoko, Suwa, Tatsu-numa, Kojima), 2 ponds (carp and goldfish) and 2 rivers (Yurappu and Takame), the studies concentrated on the biomass and productivity of plant, animal

and microbial inhabitants of these waters. —Copyright 1977, Biological Abstracts, Inc.
W77-12987

BOTTOM MICROFLORA AND BENTHOS OF LAKE DAL'NEYE (KAMCHATKA), (IN RUSSIAN),

Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 5C.
W77-12988

DEHYDROGENASE ACTIVITY IN THE BOTTOM SEDIMENTS OF THREE LAKES,

Nicolas Copernicus Univ. of Torun (Poland). Inst. of Biology.
For primary bibliographic entry see Field 5C.
W77-12989

RELATIONSHIPS BETWEEN PHOTOSYNTHETIC PRODUCTION AND LIGHT PENETRATION IN WATERS OF LAKE BERRE, (IN FRENCH),

Centre Universitaire de Luminy, Marseille (France). Lab. of Prod. Pelagique.
M. Minas.
Tethys 7(2/3), p 131-136, 1975 (1976).

Descriptors: *Photosynthesis, *Light, Lakes, *Productivity, Model studies, Turbidity, Mineralogy.
Identifiers: Carbon-14, Lake Berre(France).

Daily production rate measurements by the 14C method are compared with theoretical values calculated by application of Talling and Rodhe's models in Lake Berre waters. The use of these models is not always in agreement in a lake in which mineral turbidity is often high. —Copyright 1977, Biological Abstracts, Inc.
W77-12990

PLANT INDICATORS OF HYDROCHEMICAL CONDITIONS OF LIMANS OF THE KALMYK STEPPE, (IN RUSSIAN),

Gorodskaya Sanitarno-Epidemiologicheskaya Stantsiya, Moscow (USSR).
M. D. Fatelevich.
Ekologiya 6(5), p 102-104, 1975.

Descriptors: Indicators, *Bioindicators, Chemistry, *Phreatophytes, Grasses, *Marshes, Meadows, Mineralogy, Plant growth.
Identifiers: *Limans, *USSR(Kalmyk Steppe).

Limans are depressions on flat lowlands with a diameter from several tens of meters to several kilometers which are filled with water during the melting of snow and dry out in the summer, changing to marshes or meadows with a tall grass stand. Data are presented on plant indicators of the hydrochemical conditions of limans of steppes in the Kalmyk ASSR (USSR). The distribution of dominant plant species at different geomorphologic levels (lower, middle, upper) of the liman indicated that each of these levels has unique conditions of mineralization of the subsurface waters and can be regarded as a special hydrochemical zone. The most promising for finding fresh waters is the lower level with a predominance of glycoliphic phreatophytes. —Copyright 1977, Biological Abstracts, Inc.
W77-12991

THE MICRO- AND MESOBENTHOS OF SOME BODIES OF WATER IN THE SYR DARYA BASIN, (IN RUSSIAN),

Sredneaziatiskii Nauchno-Issledovatel'skii Institut Irrigatsii, Tashkent (USSR).
K. V. Gromyko.
Gidrobiol Zh. 12(6), p 80-84, 1976.

Field 2—WATER CYCLE

Group 2H—Lakes

Descriptors: *Benthos, *Biomass, *Copepods, Reservoirs, *Nematodes, Mineralogy, Seasonal, Detritus.
Identifiers: *USSR(Syr Darya basin), *Testaceans.

Analyses of the Kairakkum Reservoir and the Dal'verzin and Arnasaiskie lakes in Central Asia (USSR) revealed 95 forms of microbenthos and 68 forms of mesobenthos. The microbenthos was dominated by testaceans in numbers and nematodes in biomass, while the mesobenthos showed, with some exceptions, a predominance of copepods in both number and biomass. With the exception of the argilophilic complex of the Kairakkum Reservoir, microbenthos exceeded mesobenthos in both number and biomass. The qualitative composition of the micro- and mesobenthos was affected by the degree of water mineralization, while the quantitative composition was subject to seasonal variations. A richer microfauna accompanied higher detritus concentrations.—Copyright 1977, Biological Abstracts, Inc.

W77-12292

2I. Water In Plants

ROOT SYSTEM OF SHRUB LIVE OAK: IMPLICATIONS FOR WATER YIELD IN ARIZONA CHAPARRAL.

Rocky Mountain Forest and Range Experiment Station, Tempe, Ariz.

For primary bibliographic entry see Field 3B.
W77-12287

EFFECT OF WATER STRESS ON $14CO_2$ FIXATION AND TRANSLOCATION IN WHEAT DURING GRAIN FILLING.

Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.

For primary bibliographic entry see Field 3F.
W77-12289

SOIL MOISTURE REDISTRIBUTION AS AFFECTED BY THROUGHFALL AND STEMFLOW IN AN ARID ZONE SHRUB COMMUNITY.

Queensland Dept. of Primary Industries, Charleville (Australia). Charleville Pastoral Lab.
A. J. Pressland.
Australian Journal of Botany, Vol. 24, No. 5, p 641-649, 1976, 4 fig, 1 tab, 21 ref.

Descriptors: *Soil-water-plant relationships, *Stemflow, *Throughfall, *Soil moisture, *Vegetation effects, *Infiltration rates, Australia, Shrubs, Soil water movement, Plant growth, Arid lands, Trees, Rainfall, Storage capacity.

The effects of mulga (*Acacia aneura*) density on throughfall and the consequent soil moisture changes are examined. Stemflow was an important factor in soil moisture storage, especially with medium size (around 75 millimeters) precipitation events. Throughfall increased with total rainfall and percent throughfall decreased as tree density increased. No distinct soil moisture changes were found which could be related to throughfall. Infiltration rates decreased as distance from a tree bole increased, thus indicating that most stemflow water is absorbed into the soil close to the tree. The importance of stemflow and soil moisture patterns to mulga survival and growth is discussed. (Fronsdorf-Arizona)
W77-12290

WATER RELATIONS AND PHOTOSYNTHESIS OF A DESERT CAM PLANT, AGAVE DESERTI, California Univ., Los Angeles. Dept. of Biology.

For primary bibliographic entry see Field 2D.
W77-12292

EFFECT OF SOME HYDROMECHANICAL FACTORS ON THE PHYSIOLOGICAL STATE OF MICROCYSTIS AERUGINOSA KUETZ. EMEND EKENK. (IN RUSSIAN), Akademiya Nauk USSR, Kiev. Institut Hidrobiologii. V. I. Bykovskii. Gidrobiol Zh 12(3), p 29-34, 1976.

Descriptors: *Algae, Turbulence, *Cytological studies, *Cavitation, Aquatic plants, *Plant physiology, Reproduction, Viability.
Identifiers: *microcystis-aeruginosa.

When alga suspensions are pumped and separated the algae are briefly subjected to a complex of hydromechanical factors (high turbulence of flow, cavitation, hydraulic impact, etc.). This causes an intensive fractionation of colonies to fragments and free cells. The viability of colonies and cells passed through pumps and a separator did not differ essentially from the control. Experiments on the detection of possible latent damage of the alga cells after pumping and checks of their regenerative ability showed that for the period of growth (9 days) the viability of colonies and cells was high (80-90%) and did not differ from the control. The cells preserved their ability to reproduce.—Copyright 1977, Biological Abstracts, Inc.
W77-12321

A NEW MODEL OF THICKET DREDGE, (IN RUSSIAN), Akademiya Nauk SSSR, Leningrad. Institut Ozerovedeniya.

For primary bibliographic entry see Field 7B.
W77-12347

ABOUT THE PRESENCE OF THE MICROMEDUSAE CRASPEDACUSTA SOWERBYI LAKE IN THE UMBRIAN COURSE OF TIBER RIVER, (IN ITALIAN), Perugia Univ. (Italy). Inst. of Zoology.

F. Cianficconi, Q. Pirisini, and F. Tucciarelli. Riv Idrobiol 13(2/3), p 377-386, 1974.

Descriptors: Rivers, *Microorganisms, Environment.
Identifiers: *Craspedacusta-Sowerbyi, *Italy(Tiber River), *Micromedusae.

The presence of young medusae found on May 31, June 21 and July 3, 1974 in an Umbrian biotope of the Tiber River (Perugia) is pointed out. The micromedusae have a diameter of 0.6-1 mm and 16 short tentacles around the umbrella margin. The environmental conditions of the discovery zone are variable during the year. This represents the 1st find in the running waters of Italy.—Copyright 1977, Biological Abstracts, Inc.
W77-12467

EXPERIMENTAL STUDY AND NUMERICAL SIMULATION OF THE SUBSOIL WATER ENVIRONMENT, (IN FRENCH), CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les Durance (France). Service de Radio-Agronomie.

For primary bibliographic entry see Field 2G.
W77-12572

EMERGENCE OF TRICHOPTERA IN 1972-74 FROM TWO STREAMS NEAR LUNZ (AUSTRIA), (IN GERMAN), Biological Station, Lunz am See (Austria).

H. Malicky. Arch Hydrobiol 77(1), p 51-65, 1976.

Descriptors: Streams, Greenhouses, Biomass, *Aquatic insects, Temperature.
Identifiers: *Austria, *Biocoenoses, *Trichoptera.

Quantitative results of the Trichoptera emergence, obtained by the greenhouse method, in 2 mountain

streams in SW Lower Austria in 1972-74 are presented and discussed. The total biomass of emerging insects lies between 20 and 30 Kcal/m². yr for both streams, which show considerable differences in temperature and structure of the biocoenoses.—Copyright 1976, Biological Abstracts, Inc.
W77-12609

SIMULATION OF PHOSPHORUS CYCLING IN SEMIARID GRASSLANDS, Agricultural Research Service, Fort Collins, Colo. Phosphorus Lab.

For primary bibliographic entry see Field 2G.
W77-12832

REGULATION OF GRAIN YIELD BY PHOTOSYNTHESIS IN MAIZE SUBJECTED TO A WATER DEFICIENCY,

Department of Scientific and Industrial Research, Palmerston North (New Zealand). Plant Physiology Div.

For primary bibliographic entry see Field 3F.
W77-12841

WATER RELATIONS OF LETTUCE: I. INTERNAL PHYSICAL ASPECTS FOR TWO CULTIVARS,

Agricultural Univ., Wageningen, (Netherlands). Dept. of Horticulture.
M. H. Behboudian, and H. M. C. Van Holsteijn. Scientia Horticulturae, Vol. 7, No. 1, p 9-17, June, 1977, 2 fig, 1 tab, 25 ref.

Descriptors: *Lettuce, *Drought tolerance, *Drought resistance, Droughts, Electrical conductance, Field crops, Moisture content, Transpiration, Osmotic, Pressure, Moisture stress, Osmosis, Plant physiology, Dew point, Consumptive use, Vegetable crops, Crop production, Crop response.
Identifiers: Sap electrical conductivity, Plant water potential.

Since water as a critical resource is becoming increasingly important, further studies of vegetable responses to drought seem appropriate. To gain information on the reactions of lettuce to drought, water relation parameters and gas exchange rates were measured in drying-cycle experiments. The results are presented in two papers. This paper deals with physical aspects of internal water relations such as variations in plant water potential, relative water content, and sap osmotic potential and electrical conductivity with drought. Experiments were conducted with two lettuce cultivars of different origin. The results are presented. With suspension of irrigation, all the parameters decreased except for the electrical conductivity which increased. Leaf water potentials and osmotic potentials were lower in 'Amanda Plus,' a Dutch cultivar, than in 'Sucrine,' a French cultivar. A high significant correlation between plant water potential and sap electrical conductivity was found to occur, thus providing a satisfactory method for measuring water potential indirectly. (Jamail-Arizona)
W77-12844

NUTRITION OF BOSMINA COREGONI BAIRD (CLADOCERA), (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.

L. M. Semenova. Gidrobiol Zh. 10(3), p 39-46, 1974.

Descriptors: *Bacteria, Diatoms, Cyanophyta, *Crustaceans, Nutrients, Seasonal.
Identifiers: *Bosmina-coregoni.

The nutrition spectrum of *B. coregoni* is wide. *B. coregoni* eat mixed foods, preferring bacteria and Diatomae in spring and Cyanophyceae in autumn. Conditions for *B. coregoni* are most favorable with

the water temperature 18-20°C and food concentration not less than 2-8 mg/l. The average daily ration is about 100% of the body weight; the assimilation value is rather stable: 46% of the ration. —Copyright 1975, Biological Abstracts, Inc. W77-12931

PLANT INDICATORS OF HYDROCHEMICAL CONDITIONS OF LIMANS OF THE KALMYK STEPPE, (IN RUSSIAN),
Gorodskaya Sanitarно-Epidemiologicheskaya Stantsiya, Moscow (USSR).
For primary bibliographic entry see Field 2H. W77-12991

2J. Erosion and Sedimentation

EFFECTS OF CHANGE IN STREAM REGIMEN BELOW GLEN CANYON DAM ON THE MORPHOLOGY OF THE COLORADO RIVER,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
E. M. Laursen, S. Ince, and E. Silverston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 733. Price codes: A02 in paper copy, A01 in microfiche. Completion Report, 1977. 5 p, 5 ref. OWRT A-038-ARIZ(3), 14-31-0001-4003.

Descriptors: *Degradation(Stream), Erosion, Colorado River, Flow control, *Stream erosion, Channel morphology, Sediments.
Identifiers: River behavior, *Stream morphology.

With the closure of Glen Canyon Dam the stream regimen of the Colorado River was changed, flows were controlled so that there were no longer any floods, and all sediment coming down was trapped. As a result the river is degrading and in about 200 years the process will have changed the river all the way to Lake Mead. Except for those beaches faced with cobbles through self-armouring, the existing sandy beaches will be gone. The process is slow but inevitable and the effects are apparent already in the reach of river down to Lees Ferry.
W77-12265

RELEASE AND SORPTION OF PHOSPHORUS BY SEDIMENTS IN A MOVING WATER-COURSE,
South Dakota School of Mines and Technology, Rapid City. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B. W77-12273

THE CONTRIBUTION OF RED CLAY EROSION TO ORTHOPHOSPHATE LOADINGS INTO SOUTHWESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Chemistry.
For primary bibliographic entry see Field 5B. W77-12307

TWO NEW METHODS FOR OBTAINING WATER SAMPLES FROM SHALLOW AQUIFERS AND LITTORAL SEDIMENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.; and Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 7B. W77-12310

THE DETERMINATION OF TOTAL NITROGEN IN SEDIMENTS USING AN INDUCTION FURNACE,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A. W77-12313

ERODIBILITY OF SOME MINNESOTA SOILS,
Agricultural Research Service, Morris, Minn. R. A. Young, and C. K. Mutchler.
Journal of Soil and Water Conservation, Vol 32, No 3, p 180-182, July 1977. 3 tab, 22 ref.

Descriptors: *Erosion, *Minnesota, *Soils, *Erosion rates, *Soil erosion, Runoff, Bulk density, Equations, Silts, Montmorillonite, Hydrology. Identifiers: *Erodibility, Soil loss, Aggregate index, Universal soil loss equation, Dispersion index.

Soil erodibility factors from 13 Minnesota soils were calculated based on measured soil loss and on runoff from standard simulated rainstorms. Regression analysis of erodibility on 10 soil characteristics plus runoff indicated that 5 soil variables—aggregate index, dispersion ratio, bulk density, percent silt and very fine sand, and amount of montmorillonite in the soil—explained 90% of the variance in the calculated K values. When currently used K values obtained from the soil erodibility nomograph and SCS determinations were compared with the calculated K values, it was found that the currently used values underestimated the erodibility of 6 and overestimated the erodibility of 3 of the 13 soils tested. (Lee-ISWS)
W77-12317

MOVEMENT OF COBBLES IN A GRAVEL-BED STREAM DURING A FLOOD SEASON,
California Univ., Berkeley. Dept. of Geology and Geophysics.
P. R. Butler.
Geological Society of America Bulletin, Vol 88, No 8, p 1072-1074, August 1977. 4 fig, 2 tab, 5 ref.

Descriptors: *Sediment transport, *Perennial streams, *Wyoming, *On-site investigations, Gravels, Movements, Coarse sediments, Tracking techniques, Measurement, Bed load, Streamflow, Streams, Braiding, Instrumentation, Floods, Streambed, Particle size.
Identifiers: *Horse Creek(Wyo), Cobbles.

In a gravel-bed perennial stream in western Wyoming, 159 cobbles were tagged and placed on the stream bed. In a study of this type, one cannot expect to find all the tagged rocks. A search of the surface of the channel was made for an additional 500 m below the study site without locating any tagged cobbles. Therefore, it was assumed that the point bar between stations 300 and 500 represents the maximum extent of cobble movement. After one flood season during which the peak flow was 34 cu m/s, 35% were recovered. Of those recovered, 61% had been buried. The b axis of the tagged rocks ranged from 34 mm to 116 mm. The distance transported ranged from 0 to 420 m; 95% of the recovered cobbles had moved. There was no clear relationship between particle size and distance transported; distance of transport seemed to be more closely related to position (stream edge or center) at time of entrainment. Susceptibility to burial seems to be related to both particle size and position at time of entrainment. (Humphreys-ISWS)
W77-12318

STREAM JUNCTIONS-A PROBABLE LOCATION FOR BEDROCK PLACERS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
M. P. Mosley, and S. A. Schumm.
Economic Geology, Vol 72, No 4, p 691-694, June-July 1977. 4 fig, 13 ref. NSF GA 38606.

Descriptors: *Channel erosion, *Scour, *Laboratory tests, *Junctions, Streams, Alluvial channels, Sedimentation, Erosion, Geomorphology, Model studies, Bed load, Stream erosion, Sediment load, Sediments, Dunes, River beds, Placer mining, Hydraulic mining, Topography. Identifiers: Scour holes.

The results from an experimental study of stream confluences indicated that bedrock scour depths would be greatest at the confluence of streams. The scour will be deepest at junctions of tributaries that have discharges (drainage areas) that are from half to equal the amount conveyed by the main channel, have small bed-load transport rates, and meet at angles between 60 deg and 90 deg. Field observations are not available to test the conclusions; nevertheless, the above conclusions may have important implications for the location of placer deposits. Needless to say, the enhanced sediment reworking due to the turbulence at tributary junctions will promote heavy-mineral concentrations at these locations. As placer minerals are known to be deposited preferentially in and around depressions in the bedrock surface, valley confluences seem to be very promising areas for prospecting. It is significant that segregation of magnetite occurred just downstream of the scour holes in the model channel confluences. In addition, if there is a repeating pattern of bedrock scour on valley floors, the uppermost scour of the series will be at a tributary junction. (Humphreys-ISWS)
W77-12322

EFFECTS OF TOW TRAFFIC ON THE RESUSPENSION OF SEDIMENTS AND ON DISSOLVED OXYGEN CONCENTRATIONS IN THE ILLINOIS AND UPPER MISSISSIPPI RIVERS UNDER NORMAL POOL CONDITIONS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Engineering Effects Lab.
For primary bibliographic entry see Field 5C. W77-12331

EFFECTS OF DESIGN FACTORS ON SEDIMENTATION BASIN PERFORMANCE,
Minnesota Dept. of Natural Resources, St. Paul.
For primary bibliographic entry see Field 4D. W77-12514

OBSERVATIONS OF BARRED COASTAL PROFILES UNDER THE INFLUENCE OF RISING WATER LEVELS, EASTERN LAKE MICHIGAN, 1967-71,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2H. W77-12540

THE EFFECT OF EROSION ON THE WATER AND PHYSICO-CHEMICAL PROPERTIES OF SOIL ON THE ALTAI MOUNTAIN SLOPES NEAR THE OB RIVER (USSR), (IN RUSSIAN),
Altaiiskii Nauchno-Issledovatel'skii Institut Sel'skogo Khozyaystva, Barnaul (USSR).
A. N. Kashtanov, L. V. Zhezher, G. V. Zhuravleva, and V. E. Musokranov.
Pochvovedenie 3, p 105-114, 1976.

Descriptors: *Soil erosion, *Soil chemical properties, *Soil physical properties, Soil horizons, Humus, Nitrogen, Phosphorus, Slopes, Crops. Identifiers: *USSR(Ob River).

The increase of soil erodibility resulted in changes of several soil characteristics: the thickness of human horizons decreased up to 64%, the total humus content decreased up to 36%, that of N up to 36.2%, and P up to 19.7%. A decrease occurred in total exchangeable bases, an increase in specific and volume weights, and a decrease in porosity of soils. Water stability of slightly and moderately eroded soils decreased by 9-18% and of strongly eroded soils by 30%. The maximum content of available moisture was observed in the 1 m layer of the moderately eroded chernozem, 25.5 mm less than in the noneroded chernozem. The shortage in the yields on moderately eroded soils for individual crops, as compared with noneroded soils, was 28.6% for wheat, 14.8% for oats, 28.7% for

Field 2—WATER CYCLE

Group 2J—Erosion and Sedimentation

maize, and 8.7% for perennial grasses (lucerne + brome-grass).v-Copyright 1976, Biological Abstracts, Inc.
W77-12543

A PRIMER OF BASIC CONCEPTS OF LAKESHORE PROCESSES,

Coastal Engineering Research Center, Fort Belvoir, Va.
D. B. Duane, D. L. Harris, R. O. Bruno, and E. B. Hands.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A008 010. Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper No. 1-75, January 1975. 29 p, 116 ref.

Descriptors: *Lake shores, *Great Lakes, Waves(Water), Beach erosion, Currents(Water), Coasts, Sediment transport, Deposition(Sediments), Geomorphology, Lake stages, Dunes, Coastal engineering, Tides, Energy equation, Flow, Frequency.

Identifiers: Lakeshore processes, Longshore currents, Wind-generated waves, Conservation of mass.

Water waves and currents vary, among other things, with geography, water level (stage of tide), season, and offshore slope. The net effect of wave and current forces impinging upon a shoreline, ocean or lake is to change the morphology of the coastline as a result of erosion, transport, and deposition of sediment. In general, the model of sediment transport can be thought of as movement of a sand grain from some source such as a headland, to a barrier beach, to a dune, into an inlet, or to an offshore sink. Knowledge of the processes of erosion, transportation, and deposition of sediment implicit in the model is of value to the engineer and the geologist as well as the shoreline property owner. Concepts of generation of water motions and directions of flow, characteristics of flow, water levels and their periodicity, bed form generation and movement, and sediment entrainment and transport are fundamental to the understanding of lakeshore processes. Basic aspects of these concepts, in lay terms, were presented in this report. (Visocky-ISWS)
W77-12545

TRANSIENT WIND EROSION: A STUDY OF THE NONSTATIONARY EFFECT ON RATE OF WIND EROSION,

Kansas State Univ., Manhattan. Dept. of Chemical Engineering.

L. T. Fan, and L. A. Disrud.
Soil Science, Vol. 124, No. 1, p 61-65, July 1977. 2 fig, 1 tab, 6 ref.

Descriptors: *Wind erosion, *Laboratory tests, *Soil erosion, *Erosion, Sands, Soils, Turbulent flow, Wind velocity, Winds, Model studies, Sediment transport, Movement, Measurement, Evaluation.

Identifiers: Wind tunnel.

Wind velocities are often nonstationary, with an almost cyclical repetition of strong gusts followed by relative calmness. Measurements of sand movement in nonstationary winds made in a wind tunnel to test the hypothesis that the transient effects of wind velocity significantly affect the rate of sand movement. Sand movement was determined by exposing a tray of sand to various velocity patterns and weighing sand removed from the tray. Estimates of rates of sand removal during nonstationary wind far more closely approximate the measured rates than the stationary estimates. Data from the study led to the conclusion that the effects of nonstationary wind velocity on sand transport are significant, and a transient or unsteady-state model is necessary to estimate rates of wind erosion in the field. (Humphreys-ISWS)
W77-12552

STREAM-CHANNEL RESPONSE TO FLOODS, WITH EXAMPLES FROM CENTRAL TEXAS,

Texas Univ. at Austin. Dept. of Geological Sciences.
V. R. Baker.

Geological Society of America Bulletin, Vol. 88, No. 8, p 1057-1071, August 1977. 19 fig, 68 ref.

NAS 9-13312.

Descriptors: *Stream erosion, *Channel morphology, *Geomorphology, *Texas, *Streams, Sediment transport, Flood frequency, Climatic zones, Channels, Flow resistance, Streamflow.

Identifiers: Stream geometry, Stream response.

It is recognized generally that most geomorphic work is accomplished by relatively frequent events of moderate intensity. However, stream channels in certain climatic and physiographic settings are an exception to the rule. Small drainage basins in regions of highly variable flood magnitudes appear to have a high potential for catastrophic response. Highly right-skewed flood-frequency distributions in certain arid regions of south western United States indicate such a potential. High-magnitude flood response is aided by physiographic factors such as hillslope morphology, soils, rock type, and drainage density. Another important factor for the catastrophic stream-channel response is the resistance of the channel to scour. A high response threshold is required to scour bouldery alluvium and dense valley bottom vegetation. Catastrophic stream-channel response is a local phenomenon that illustrates the variety of interactions in the fluvial system. (Singh-ISWS)
W77-12553

GEOTHERMAL GRADIENTS IN BRITISH LAKE SEDIMENTS,

Institute of Oceanographic Sciences, Merseyside (England). Bidston Observatory.

D. T. Pugh.

Limnology and Oceanography, Vol. 22, No. 4, p 581-596, July 1977. 7 fig, 7 tab, 27 ref.

Descriptors: *Geothermal studies, *Lake sediments, *Heat flow, Temperature, Water temperature, Sediments, Foreign research, Heat transfer, Lakes, Foreign countries, On-site investigations, On-site data collections, Climatology, Limnology, Geology.

Identifiers: *Geothermal gradients, *Loch Ness(Scotland), *Windermere(England), Bottom water temperature, Sediments temperature.

Temperature were measured in the water and sediments of Loch Ness and Windermere to investigate the possibility of determining the geothermal heat flow through the bottom of deep British lakes. The accuracy is limited by corrections for annual and long term variations in bottom water temperatures. In Loch Ness (max depth 232 m), the annual temperature variation of the deep water is normally less than 0.5 C. There is evidence of a benthic water layer overlying the sediments in the deepest parts of the loch in which the annual variations are probably not more than 0.2C. When corrections were made, the mean of 13 measurements of heat flow in Loch Ness was 1.45 microcal/sq cm/s. Values increase steadily from 1.03 microcal/sq cm/s in the northeast to 1.74 in the southwest, with local high values near the Foyers granite intrusion. Annual variations in bottom water temperature in Windermere (max depth 65 m) are greater than 2.5C, though variations in the benthic layer are less. Reliable geothermal heat flow measurements were possible only because an extended series of measurements was available. The mean of three acceptable results was 1.69 microcal/sq cm/s. (Sims-ISWS)
W77-12558

DEMONSTRATION OF COAL MINE HAUL ROAD SEDIMENT CONTROL TECHNIQUES,

Mayes, Sudderth and Etheredge, Inc., Lexington, K. Y.

For primary bibliographic entry see Field 5G.

W77-12559

PROTECTION OF SLOPES AGAINST RAIN-FALL EROSION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.

For primary bibliographic entry see Field 4D.

W77-12561

REPORT ON STATE SEDIMENT CONTROL INSTITUTES PROGRAM.

Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.

For primary bibliographic entry see Field 5G.

W77-12565

BEACH FILL STABILITY AND BORROW MATERIAL TEXTURE,

Coastal Engineering Research Center, Fort Belvoir, Va.

W. R. James.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A0100 753. Price codes: A02 in paper copy, A01 in microfiche. Report R 13-74, June 1974. Reprint from Proceedings of the 14th Coastal Engineering Conference, Copenhagen (Denmark), American society of Civil Engineers, p 1334-1349, June 1974. 2 fig, 6 ref.

Descriptors: *Beaches, *Beach erosion, *Shores, *Model studies, Mathematical models, Stability, Erosion, Coasts, Sediments, Sands, Sediment transport, Coastal engineering.

Identifiers: *Artificial beach nourishment, Borrow materials, Beach fill stability.

The dependence of beach fill stability on the textural properties of borrow material requires development of quantitative methods for use in selection of borrow areas and in prediction of possible maintenance costs associated with periodic renourishment. If a shore segment is viewed as a sediment mass transfer system, where grains of different size have different transport rates, then termination of natural sediment input to the shore segment will cause the beach to retreat, and the materials in the active zone will become coarser. The ratio of retreat rates associated with a given borrow material texture to that associated with native material can be used in optimizing economic factors involved in selection among potential borrow zones. With certain simplifying assumptions, the relative retreat rate associated with a given borrow material texture can be predicted from observations of the modifications in textural properties of native material which occur during the eroding condition following termination of the natural supply of sediment. Further simplifying assumptions result in an analytical expression for relative retreat rates which may not require observations of the natural beach in the eroding condition. (Sims-ISWS)
W77-12566

DISTRIBUTION OF MANGANESE, NICKEL, ZINC, CADMIUM, AND ARSENIC IN SEDIMENTS AND IN THE STANDARD ELUTRIATE,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.

For primary bibliographic entry see Field 5A.

W77-12574

TWO-DIMENSIONAL MODEL OF EROSION FROM A WATERSHED,

Texas A and M Univ., College Station. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 4D.

W77-12575

RUNOFF AND SOIL EROSION ON SLOPES DEPENDENT ON CULTIVATED CROPS, (IN RUSSIAN),

Vsesoyuznyi Nauchno-Issledovatel'skii Institut Kukuruzny, Dnepropetrovsk (USSR).
I. A. Pabit, N. F. Benedichuk, and V. M. Krut'.
Pochvovedenie 2, p 107-114, 1976.

Descriptors: *Soil erosion, *Slopes, Crops, Cultivation, *Runoff, Precipitation (Atmospheric), *Snow melt, Soil moisture, Corn (Field).

Soil erosion and runoff from fall-plowed fields, bare fallows, fields under row crops, winter crops after fallow and after maize for silage, summer cereal crops and annual and perennial grasses in the N Ukrainian steppe, USSR, were studied. A relationship between soil erosion and the intensity of precipitation and snow melting, field management practices and the moisture and structural state of the soil on different agricultural backgrounds is shown.—Copyright 1976, Biological Abstracts, Inc.
W77-12587

GRASSLAND RENOVATION - CONSERVES SOIL AND ENERGY AND INCREASES RETURNS FROM GRASS FIELDS,

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W77-12622

DEPOSITION AND EROSION IN AN ALLUVIAL CHANNEL (LES PHENOMENES DE DEPOSITION ET D'EROSION DANS UN CANAL ALLUVIONNAIRE),

Ecole Polytechnique Federale de Lausanne (Switzerland). Laboratoire d'Hydraulique.
W. H. Graf, and G. C. Pazis.
Journal of Hydraulic Research, Vol. 15, No. 2, p 151-166, 1977. 9 fig, 3 tab, 7 ref.

Descriptors: *Deposition (Sediments), *Erosion, *Laboratory tests, *Sediment transport, Movement, Reynolds number, Channel erosion, Bed load, Shear, Foreign research, Hydraulic models, Laboratory equipment, Alluvial channels, Saltation, Sedimentology.

Deposition and erosion of sediment particles were studied experimentally in a laboratory channel. It was found that for the same hydraulic conditions, deposition gives different numerical results than erosion gives. While erosion has been studied sufficiently before, a systematic investigation on deposition has - to the authors' knowledge - never been done before. The results of the study were shown as two families of curves - one for deposition and one for erosion. For the same sedimentary material and the same shear stress, the number of particles in movement, is smaller for erosion than for deposition. If results are compared with Shields' function, it is noticed that the particle motion is more intense if the Reynolds number is smaller. To obtain the data, a special 'particle-counting' system utilizing a laser was developed and described. (Humphreys-ISWS)
W77-12797

STREAM NETWORK VOLUME: AN INDEX OF CHANNEL MORPHOMETRY,

Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W77-12802

EROSION AND SEDIMENT CONTROL AUDIOVISUAL TRAINING PROGRAM, INSTRUCTOR'S MANUAL,

Hittman Associates, Inc., Environmental and Geosciences Dept.
For primary bibliographic entry see Field 5G.
W77-12815

THE RESPONSE OF FLOODS AND SEDIMENT YIELDS TO CLIMATIC VARIATION AND LAND USE IN THE UPPER MISSISSIPPI VALLEY,

Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 2E.
W77-12822

EFFECTS OF MAN ON SEDIMENTATION AND EROSION IN RURAL ENVIRONMENTS,

Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 4D.
W77-12843

APPLICATION OF A 'RADIATION-TYPE' BOUNDARY CONDITION TO THE WAVE-POROUS PROBLEM,

North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.
For primary bibliographic entry see Field 2L.
W77-12911

FLOW DYNAMICS AND SEDIMENT MOVEMENT IN LOCKWOODS FOLLY INLET, NORTH CAROLINA,

North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.
For primary bibliographic entry see Field 2L.
W77-12913

PREDICTION OF LITTORAL DRIFT FOR LAKES AND BAYS FROM WIND OBSERVATIONS,

Florida Univ., Gainesville. Dept. of Civil Engineering; and Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
H. Rubin, and T. L. Walton, Jr.
Reprinted from: Southeastern Geology, Vol 18, No 2, p 119-127, December 1976. 6 fig, 13 ref.

Descriptors: *Littoral drift, *Winds, *Sediment transport, *Climatic data, *Florida, Lakes, Bays, *Forecasting.
Identifiers: *Wave action, Nearshore zone.

The quantity of sand moved in the nearshore zone is dependent on the characteristics of breaking waves, longshore currents, and the physical characteristics of sediment in the surf zone. The longshore sediment transport on open coasts is related to the longshore flux of energy produced by the breaking waves. In many locations such as closed bays and lakes, waves are generated mainly by local winds. In these locations climatological (wind) data can be used for the prediction of sediment movement. This study utilizes wind data for evaluation of shoreline changes that occur in Choctawhatchee Bay, Florida. The study indicates that some important features of the shore can be predicted from a knowledge of sand transport derived from wind statistics. A conclusion of the study is that wind data can be useful for the analysis of shore processes in enclosed bays and lakes. (NOAA)
W77-12958

2K. Chemical Processes**HYDROCHEMICAL ZONALITY OF GROUNDWATERS IN THE ARID ZONES OF THE USSR,**

Akademiya Nauk SSSR, Moscow. Interagency Geophysical Committee.
G. V. Bogomolov, and V. I. Dukhanina.
Hydrological Sciences Bulletin, Vol 22, No 1, p 77-81, March 1977. 1 fig, 17 ref.

Descriptors: *Geochemistry, *Geologic control, *Water chemistry, *Artesian aquifers, *Groundwater basins, Saline water, Brines, Hydrogeology, Arid climates, Temperate, Cli-

matic zones, Bicarbonates, Mountains, Chemical properties, Foreign countries, Foreign research.
Identifiers: *USSR, *Hydrochemical zones, Inverted zones, Piedmont, Intramountain areas.

The vertical sequence of different hydrochemical zones in the crust determines the character of hydrochemical zonality of groundwaters in the different regions of the USSR. Within the temperate climatic belt, the typical zonality is an upper zone of fresh hydrocarbonate-calcium waters over a zone of salty sulphate waters; the thickest zone of salt waters and concentrated brines (calcium chloride) being located at still greater depths. In the arid zones, the upper hydrochemical zone uniformly comprises pressureless and low pressure salt groundwaters and brines. Potable waters occur as small lenses or thin layers above salt waters, usually under topographic microdepressions. In the intramountain and piedmont artesian basins, an inverted hydrochemical zonality of groundwaters is observed. Powerful subterranean streams of ultra-fresh hydrocarbonate composition are formed in the very wet mid- and high-altitude mountain regions, and in the adjoining piedmont and intramountain basins the waters form a thick hydrochemical zone of low mineralized waters below an upper zone of salt waters. Eight different artesian basins of the USSR arid zones were shown to have inverted hydrochemical zonality. (Visocky-ISWS)
W77-12311

FLAWS OF SODIUM, POTASSIUM, MAGNESIUM AND CALCIUM IN THE R. CYNON, S. WALES,

University of Wales Inst. of Science and Technology, Cardiff (Wales). Dept. of Applied Biology.
For primary bibliographic entry see Field 5B.
W77-12320

BINARY GAS DIFFUSION OF METHANE-NITROGEN THROUGH POROUS SOLIDS,

Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2F.
W77-12323

MASS SPECTROMETRIC ANALYSIS OF PRODUCT WATER FROM COAL GASIFICATION,

Energy Research and Development Administration, Pittsburgh, Pa. Pittsburgh Energy Research Center.
For primary bibliographic entry see Field 5A.
W77-12328

WELL RECORDS, WATER-LEVEL MEASUREMENTS, LOGS OF TEST HOLES, AND CHEMICAL ANALYSES OF GROUND WATER IN THE CACHE RIVER ALLUVIAL AQUIFER-STREAM SYSTEM, NORTHEAST ARKANSAS, 1946-76,

Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12371

HOT SPRINGS OF THE CENTRAL SIERRA NEVADA, CALIFORNIA,

Geological Survey, Menlo Park, Calif. Water Resources Div.
R. H. Mariner, T. S. Presser, and W. C. Evans.
Open-file Report 77-559, July 1977. 27 p, 2 fig, 11 tab, 34 ref.

Descriptors: *Geothermal studies, *Water chemistry, *Thermal springs, *Water temperature, *California, Stable isotopes, Oxygen isotopes, Deuterium, Carbon dioxide, Nitrogen, Oxygen, Aquifers.
Identifiers: *Central Sierra Nevada (Calif), Geothermometers.

Field 2—WATER CYCLE

Group 2K—Chemical Processes

Thermal springs of the central Sierra Nevada issue dilute to slightly saline sodium chloride, sodium bicarbonate, or sodium mixed-anion waters ranging in pH from 6.4 to 9.3. The solubility of chalcocite appears to control the silica concentration in most of the spring waters. Fales Hot Springs may be associated with a higher temperature aquifer, 150 degrees Celsius or more, in which quartz is controlling the silica concentration. Carbon dioxide is the predominant gas escaping from Fales Hot Springs, the unnamed hot spring on the south side of Mono Lake, and the two thermal springs near Bridgeport. Most of the other thermal springs issue small amounts of gas consisting principally of nitrogen. Methane is the major component of the gas escaping from the unnamed spring on Paoha Island in Mono Lake. The deuterium and oxygen isotopic composition of most of the thermal waters are those expected for local meteoric water which has undergone minor water-rock reaction. The only exceptions are the hot spring on Paoha Island in Mono Lake and perhaps the unnamed warm spring (south side of Mono Lake) which issues mixtures of thermal water and saline lake water. (Woodard-USGS)
W77-12375

INTERACTION OF CLIMATE, ORGANIC MATERIAL AND STRUCTURAL STABILITY IN MUDDY SOILS, (IN FRENCH),
For primary bibliographic entry see Field 2G.
W77-12470

THE GEOCHEMISTRY OF MANGANESE, IRON, URANIUM, LEAD-210, AND MAJOR IONS IN THE SUSQUEHANNA RIVER,
Yale Univ., New Haven, Conn. Graduate School.
D. M. Lewis.
Available from the National Technical Information Service, Springfield, VA 22161 as COO 357315. Price codes: A13 in paper copy, A01 in microfiche. PhD Dissertation 1976. 272 p, 51 fig, 47 tab, 120 ref, 6 append.

Descriptors: *Geochemistry, *Pennsylvania, *Rivers, *Baseflow, *Weathering, Groundwater, Manganese, Iron, Lead, Uranium radioisotopes, Tracers, Water quality, Mine drainage, Geologic control, Heavy metals, Sediments, Soil erosion, Trace elements, Water sampling, Water analysis, Watersheds(Basins).
Identifiers: *Susquehanna River, Scavenging, Sequestering.

Streams which drain a single general rock type have a constant concentration (+ or - 10%) of dissolved ions, while discharge may vary by 2 orders of magnitude. It was concluded that at all times the water flowing in a stream is from the groundwater system. The change in composition accompanying a change in discharge of large streams and the Susquehanna River results from the change in proportions of the total flow composed of type waters of constant composition. The in-river precipitation of mine-drainage-injected Mn and Fe was studied at a pH of about 7. For Mn, the removal from solution appears to be first order. The study of the removal of Fe from solution also yields a first order rate constant consistent with previous laboratory experiments. Mine-drainage-injected Pb210 was used to study trace metal removal kinetics in the river. At a pH of about 7, the removal of Pb210 from solution has a first order half time of less than 1 day. The dissolved and particulate U data showed that U is removed from solution onto the suspended sediment in the Susquehanna. Biological activity within the river and soil erosion introduce organic matter capable of sequestering trace metals. (Visocky-ISWS)
W77-12544

ANALYSIS OF VARIATIONS IN OCEAN COLOR,
Laboratoire de Physique et Chimie Marines, Villefranche-sur-Mer (France). Station Marine.
A. Morel, and L. Prieur.

Limnology and Oceanography, Vol 22, No 4, p 709-722, July 1977. 12 fig, 1 tab, 32 ref.

Descriptors: *Optical properties, *Reflectance, *Color, *Oceans, *Sea water, Physical properties, Analytical techniques, Refractivity, Remote sensing, Properties, *Turbidity, *Pigments, *Chlorophyll, Water quality, Upwelling, Water analysis.
Identifiers: *Reflectance ratio, *Spectral measurements, *Spectral analysis, Pigment content, Molecular scattering, Particle scattering, Dissolved matter, Particulate matter, Spectral variations.

Spectral measurements of downwelling and upwelling daylight were made in waters different with respect to turbidity and pigment content. From the data, the spectral values of the reflectance ratio just below the sea surface, R(lambda) were calculated. The experimental results were interpreted by comparison with the theoretical R(lambda) values computed from the absorption and back-scattering coefficients. The importance of molecular scattering in the light back-scattering process was emphasized. The R(lambda) values observed for blue waters were in full agreement with computed values in which new and realistic values of the absorption coefficient for pure water were used and presented. For the various green waters, the chlorophyll concentrations and the scattering coefficients, as measured, were used in computations which account for the observed R(lambda) values. The inverse process, i.e., to infer the content of the water from R(lambda) measurements at selected wavelengths, was discussed in view of remote sensing applications. (Henley-ISWS)
W77-12557

DISTRIBUTION OF MANGANESE, NICKEL, ZINC, CADMIUM, AND ARSENIC IN SEDIMENTS AND IN THE STANDARD ELUTRIATE,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
For primary bibliographic entry see Field 5A.
W77-12574

MISCIBLE DISPLACEMENT IN SOILS,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-12577

SALINITY SURVEY IN ISRAEL,
Ministry of Agriculture, Tel-Aviv (Israel). Irrigation and Soil Field Service.
M. Boaz, I. Husenberg, and Y. Posin.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976. p 388-399, 3 fig, 4 tab.

Descriptors: *Salinity, Electrical conductance, *Saline water, Chlorides, Dissolved solids, Orchards, Crop production, Crop response, *Surveys, Water distribution systems.
Identifiers: *Israel.

The Salinity Survey was initiated in the Spring of 1963, a year before the operation of the National Water Carrier, which conducts water from Lake Tiberias in the North, to the Southern parts of the Country. The electrical conductivity (EC) of the Lake water at that time was about 1.5 millimhos/cm, with a chloride content of about 350 ppm and about 1000 ppm total dissolved salts (TDS). The salinity of the Lake water at the present time is consistently lower: EC approximately 1.2 mmhos/cm; Cl approximately 250 ppm; TDS approximately 850 ppm. It was feared that the water would be too saline for the irrigation of sensitive crops like citrus, which is the country's main agricultural export. (See also W77-12726) (Skogerboe-Colorado State)
W77-12767

GEOHERMAL INVESTIGATIONS IN IDAHO: PART 7. GEOCHEMISTRY AND GEOLOGIC SETTING OF THE THERMAL WATERS OF THE CAMAS PRAIRIE AREA,
Idaho Dept. of Water Resources, Boise.
For primary bibliographic entry see Field 4B.
W77-12782

HYDROGEOCHEMICAL RELATIONSHIPS USING PARTIAL CORRELATION COEFFICIENTS,
Texas Christian Univ., Fort Worth. Environmental Sciences Program.
For primary bibliographic entry see Field 2F.
W77-12808

PROCEEDINGS OF A CONFERENCE ON EMERGING ENVIRONMENTAL PROBLEMS: ACID PRECIPITATION.
Environmental Protection Agency, New York.
For primary bibliographic entry see Field 5A.
W77-12809

ACID PRECIPITATION: A WORLD CONCERN,
Kungliga Lantbrukshogskolan, Uppsala (Sweden). Dept. of Soil Science; and Kungliga Lantbrukshogskolan, Uppsala (Sweden). Div. of Ecochemistry.
For primary bibliographic entry see Field 5A.
W77-12810

ACID PRECIPITATION: OUR UNDERSTANDING OF THE PHENOMENON,
New York Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
For primary bibliographic entry see Field 5A.
W77-12811

ACID PRECIPITATION: OUR UNDERSTANDING OF THE ECOLOGICAL EFFECTS,
Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.
For primary bibliographic entry see Field 5A.
W77-12812

CONDITIONS OF THE EMERGENCE OF SOIL TOXICITY DURING APPLICATION OF STRAW AND FLOODING, (IN RUSSIAN),
Moskovskaya Sel'skokhozyaistvennaya Akademiya (USSR). Div. of Microbiology.
For primary bibliographic entry see Field 2G.
W77-12983

2L. Estuaries

NITROGEN RECYCLING IN THE CHOWAN RIVER,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-12252

THE DISTRIBUTION OF TOXIC METALS IN MARINE ECOSYSTEMS AS A RESULT OF SEWAGE DISPOSAL AND NATURAL PROCESSES,
Duke Univ., Beaufort, N.C. Marine Lab.
For primary bibliographic entry see Field 5B.
W77-12253

FIRST OBSERVATIONS ON THE INTRODUCTION OF THE FAUNA ASSOCIATED WITH THE JAPANESE OYSTER SPAT CRASSOSTREA GIGAS (THUNBERG), IMPORTED ON THE ATLANTIC COAST OF FRANCE, (IN FRENCH),
Institut des Sciences de la Nature, Nantes (France). Laboratoire d'Ecologie Animale et Biologie Marine.

Y. Gruet, M. Heral, and J. M. Robert.
Cah Biol Mar 17, p 173-184, 1976.

Descriptors: *Oysters.
Identifiers: *Aiptasia-pulchella*, *Anomia-chinensis*, *Balanus-albicostatus*, *Balanus-amphitrite-amphitrite*, **Crassostrea-gigas*, *France(Atlantic Coast), *Hydroides-ezoensis*, *Japanese oyster spat.

Plans to introduce Japanese oysters *C. Gigas* (Thunberg) to replace Portuguese oysters has raised some biological problems. The possible introduction of turbellarian oyster predators implied a necessity for regulation when oyster spat must be dipped into fresh water. The possible implantation of the associated macrofauna developing on the Japanese oyster spat was studied. These Japanese species are living in France (baie de Bourgneuf, Vendée) 1 yr after the immersion of the original spat: the annelid *Hydroides ezoensis*, the coelenterate *Aiptasia pulchella*, the mollusk *Anomia chinensis* and the cirripeds *Balanus amphitrite* and *B. albicostatus*. Various oyster farming methods and the ecological conditions in each region could affect their possibilities of survival; however, the existence of Japanese species out of the farming areas had not been proven.—Copyright 1977, Biological Abstracts, Inc.

W77-12296

ON THE CALCULATION OF TIDAL CURRENTS IN HOMOGENEOUS ESTUARIES,
Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
C. E. Pearson, and D. F. Winter.
Journal of Physical Oceanography, Vol. 7, No. 4, p 520-531, July 1977. 5 fig, 14 ref.

Descriptors: *Estuaries, *Water circulation, *Currents(Water), *Model studies, Mathematical models, Tides, Tidal waters, Bays, Winds, Coriolis force, Computer models, Oceanography.
Identifiers: *Tidal currents.

A new approach to the computation of tidal flow in homogeneous estuaries with irregular boundary configurations and of arbitrary depth was reported in this paper. The governing equations are the standard vertically integrated expressions of momentum and mass conservation, including the effects of Coriolis acceleration, surface wind stress, and bottom friction. The motion was assumed to be periodic, and the original time-dependent equations were replaced by a set of model equations obtained by Fourier decomposition, with the nonlinear terms being treated by an iteration technique. Two types of boundary conditions at the junction of the estuary with the sea were considered: (1) the specification of tidal height as a function of time across the mouth, and (2) continuity of height and velocity at the mouth when a source at sea generates waves propagating toward the estuary. It was shown that the boundary value problems as expressed by the modal equations and the boundary conditions in each case can be rephrased in terms of variational principles. The variational principle then is used together with a finite element method to solve for the unknown variables—water surface height and depth-averaged velocities. For the purpose of illustration, the method was applied to estuaries with semi-elliptical boundaries and various bottom profiles. It appeared that the method can provide both computational speed and numerical accuracy in a wide variety of problems of practical interest. (Sims-ISWS)

W77-12297

CONTINENTAL SHELF CURRENTS IN TROPICAL STORM DELIA: OBSERVATIONS AND THEORY,
Shell Development Co., Houston, Tex.
G. Z. Forristall, R. C. Hamilton, and V. J. Cardone.

Journal of Physical Oceanography, Vol. 7, No. 4, p 532-546, July 1977. 15 fig, 14 ref.

Descriptors: *Water currents, *Storms, *Gulf of Mexico, *Model studies, Current meters, Waves(Water), Ocean waves, Ocean currents, Winds, On-site investigations, On-site data collections, Measurement, Mathematical models, Analytical techniques, Data processing, Continental shelf, Offshore platforms, Oceanography.
Identifiers: *Tropical Storm Delia(1973), Tropical storms.

Storm currents are a significant part of the design hydrodynamic flow field in areas subject to tropical storms. In September 1973, Tropical Storm Delia passed over the instrumented Buccaneer platform located in 20 m of water 50 km south of Galveston, Texas. Current meter records from three depths showed that the storm produced currents on the order of 2 m/s which persisted to near the bottom. A mathematical model of wind-driven current generation was successful in hindcasting the observed current development after a linear slip condition bottom was incorporated in the model. (Sims-ISWS)

W77-12298

THE EFFECTS OF A VARIABLE CORIOLIS PARAMETER, COASTLINE CURVATURE AND VARIABLE BOTTOM TOPOGRAPHY ON CONTINENTAL SHELF WAVES,
Melbourne Univ., Parkville (Australia). Dept. of Mathematics.
R. Grimshaw.

Journal of Physical Oceanography, Vol. 7, No. 4, p 547-554, July 1977. 4 fig, 6 ref, 2 append.

Descriptors: *Ocean waves, *Continental shelf, *Model studies, Mathematical models, Waves(Water), Coriolis force, Coasts, Topography, Mathematics, Oceanography.

The effects of a variable Coriolis parameter, coastline curvature, and variable bottom topography on continental shelf waves were examined for the case when the variations occur on a length scale much greater than the shelf width, which was assumed to be an appropriate length scale for the waves. Explicit formulas were derived for the change in amplitude and phase speed. Particularly simple formulas were derived for Kelvin waves and for long, nondivergent shelf waves. (Sims-ISWS)

W77-12299

TRACKING A GULF STREAM RING WITH A FREE DRIFTING SURFACE BUOY,
Woods Hole Oceanographic Institution, Mass.
P. L. Richardson, R. E. Cheney, and L. A. Mantini.
Journal of Physical Oceanography, Vol. 7, No. 4, p 580-590, July 1977. 8 fig, 10 ref.

Descriptors: *Ocean circulation, *Ocean currents, *Atlantic Ocean, On-site investigations, Telemetry, Satellites(Artificial), Buoys, Drift bottles, Drifting(Aquatic), Movement, Temperature, Water temperature, Winds, Oceanography.
Identifiers: *Gulf Stream rings, *Gulf Stream, Ring coalescing.

A newly developed buoy which is free drifting and tracked by satellite was used successfully to measure the movement of a Gulf Stream ring. The buoy, launched in a young ring at 36 deg 15 min N, 58 deg 00 min W, looped around its center with a period of 54 h, radius of 25 km, and speed of 75 cm/s. For two months the ring moved rapidly and consistently to the northeast with an average speed of 9 cm/s. An airborne XBT survey and satellite infrared radiometry measurements provided evidence that the ring coalesced with the Gulf Stream near 53 deg W. The study presented the most convincing evidence yet that a ring can coalesce with the Gulf Stream. When the result

was combined with the results of other studies, there was a suggestion that rings may coalesce with the Gulf Stream more frequently than previously believed. (Sims-ISWS)

W77-12300

A COMPARISON OF SUMMER CURRENT MEASUREMENTS IN THE DRAKE PASSAGE, Arkticheskii i Antarkicheskii Nauchno-Issledovatel'skii Institut, Leningrad (USSR).
A. F. Treshnikov, R. D. Pillsbury, W. D. Nowlin Jr., E. I. Sarukhanyan, and N. P. Smirnov.
Journal of Physical Oceanography, Vol. 7, No. 4, p 610-614, July 1977. 4 fig, 2 ref.

Descriptors: *Ocean currents, *Antarctic Ocean, *Antarctic, Current meters, Circulation, Ocean circulation, Currents(Water), Energy, Tides, Water circulation, Measurement, Oceanography.
Identifiers: *Drake Passage, Energy spectra.

During the austral summer of 1974-75 direct measurements of currents in the Drake Passage were made. One data set was collected by the Soviet Arctic and Antarctic Research Institute while another set was collected by Oregon State University as a part of the IDOE/ISOS program. The Soviet data from 61 deg 11 min S, 62 deg 31 min W beginning on 25 December and ending on 10 January were compared with the U.S. data collected at 60 deg 45 min S, 62 deg 15 min W. While there was spatial separation of 44 km and a time separation of 47 days, there were significant similarities in the energy spectra and in the trends of the velocity components. Comparison between moorings at 59 deg 03 min S, 63 deg 24 min W and 58 deg 46.5 min S, 64 deg 24 min W yielded similar results. (Sims-ISWS)

W77-12301

NEAR-BOTTOM CROSS-SHELF CURRENTS IN THE NORTHWESTERN GULF OF MEXICO: A RESPONSE TO WIND FORCING,
Texas Univ. at Austin, Port Aransas. Marine Science Inst.
N. P. Smith.

Journal of Physical Oceanography, Vol. 7, No. 4, p 615-620, July 1977. 6 fig, 1 tab, 10 ref.

Descriptors: *Ocean currents, *Continental shelf, *Gulf of Mexico, *Winds, *Texas, Current meters, Coasts, Measurement, Data processing, Correlation analysis, Flow, Currents(Water), Ocean currents, Ocean circulation, Wind pressure, Oceans, Oceanography.
Identifiers: *Cross-shelf currents, Wind forcing, Wind stress.

Recording current meter data from two near-bottom levels on the inner shelf of the northwestern Gulf of Mexico were presented along with wind data from November and December 1975. Four periods of predominantly cross-shelf motion were discussed, involving both onshore and offshore motion. Coherence spectra relating cross-shelf motion with the longshore and cross-shelf components of the computed wind stress showed statistically significant values at both levels. Cross-shelf motion past the upper current meter, 3.7 m above the bottom in 13.5 m of water, was more responsive to the cross-shelf component of the wind stress and indicated that near-bottom cross-shelf motion occurs as a simple return flow. At the lower level, 0.9 m above the bottom, cross-shelf currents were more coherent with the longshore component of the wind stress, suggesting a response to Ekman transport in the surface layer. A coherence spectrum of cross-shelf motion from the two levels indicated low values except over the very longest time scales. (Sims-ISWS)

W77-12302

A NOTE ON THE LATERAL MIXING OF WATER MASSES,
Woods Hole Oceanographic Institution, Mass.
T. M. Joyce.

Field 2—WATER CYCLE

Group 2L—Estuaries

Journal of Physical Oceanography, Vol. 7, No. 4, p 626-629, July 1977. 1 fig, 16 ref. NSF OCE75-14056.

Descriptors: *Oceans, *Mixing, *Salinity, *Water temperature, Model studies, Mathematical models, Heat transfer, Diffusion, Heat, Salinity, Oceanography.

Identifiers: Water masses, Thermohaline fronts, Interleaving, Intrusions.

The role of medium-scale interleaving of temperature and salinity in frontal regions was investigated, and a model was presented in which a statistical equilibrium of the medium scale is achieved. Small-scale diffusion across intrusions, causing an attenuation of T/S characteristics, is balanced by horizontal advection of heat and salt by the medium-scale motions. The 'energy' source for the balance is the lateral variation in the temperature/salinity field associated with water mass transitions. Estimates of the cross frontal heat or salt exchange can be made based upon the intensity of the interleaving T/S fields. The lateral transfer is directly proportional to the vertical transports across intrusion boundaries by microscale processes. The same general principle for the enhancement of the cross frontal heat transfer by interleaving is similar to that achieved in automobile cooling systems by a radiator. The model, in effect, attempts to quantify our ignorance of lateral mixing of water masses. It is shown also to be a generalized statistical extension of longitudinal dispersion in pipes suggested by Taylor. (Sims-ISWS)

W77-12303

SAGINAW BAY WATER CIRCULATION,
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W77-12326

FLUORESCENCE TRACING OF THE FLOW AND DISPERSION OF SULFITE WASTES IN A FJORD SYSTEM,
Göteborg Univ. (Sweden). Institutionen för Analytisk Kemi.
For primary bibliographic entry see Field 5B.
W77-12333

ARTIFICIAL RECHARGE EXPERIMENTS ON THE SHIP CREEK ALLUVIAL FAN, ANCHORAGE, ALASKA,
Geological Survey, Anchorage, Alaska, Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-12378

STUDY OF THE BENTHIC POPULATION OF DEEP SILTS FROM THE GASPÉ STRAIT (GULF OF THE SAINT LAWRENCE), (IN FRENCH),
Centre d'Océanographie, Marseille (France). Station Marine d'Endoume.
M. Ledoyer.
Trav Pech Que 44, p 1-27, 1975.

Descriptors: Littoral, *Benthos, *Canada, Gulfs, Sampling, *Benthic fauna.
Identifiers: *Mediterranean Sea, *Gulf of St. Lawrence (Gaspé Strait).

A study of some samples from bathyal biotopes revealed a fauna closely associated with this layer. This fauna occasionally rises to the circalittoral layer. Of the individuals collected in the bathyal biotope, 98% appeared to be characteristic of the population. The faunistic homologies of the bathyal fauna of the Gulf of St. Lawrence (Canada) and those of the Mediterranean Sea are apparent. —Copyright(c) 1977, Biological Abstracts, Inc.
W77-12466

OBSERVATIONS OF BARRED COASTAL PROFILES UNDER THE INFLUENCE OF RISING WATER LEVELS, EASTERN LAKE MICHIGAN, 1967-71,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2H.
W77-12540

A PRIMER OF BASIC CONCEPTS OF LAKESHORE PROCESSES,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2J.
W77-12545

WIND STRESS ON THE OCEAN OVER THE EASTERN CONTINENTAL SHELF OF NORTH AMERICA,
Woods Hole Oceanographic Institution, Mass.
P. M. Saunders.
Journal of Physical Oceanography, Vol. 7, No. 4, p 555-566, July 1977. 15 fig, 2 tab, 10 ref. ONR N00014-74-C0262.12.

Descriptors: *Wind pressure, *Continental shelf, *Atlantic Ocean, On-site data collections, Ships, Winds, Drag, Stress, Oceans, Seasonal, Annual, Temporal distribution, Spatial distribution, Climatology, Data processing, Data collections, Analytical techniques, Oceanography.
Identifiers: *Wind stress, Drag coefficients.

Employing one million ship reports gathered in the years 1941-72, seasonal averages of the wind stress and its standard deviation were computed for the shelf region of the eastern North American continent (out to a depth of 200 m). A drag coefficient was assumed which increased with wind speed, from .001 at 5 m/s to .0023 at 25 m/s. In the summer season, the 32-year climatological wind stress was toward the northeast, having a magnitude close to 0.25 dyn/sq cm throughout the entire shelf region. In the three other seasons, the stress was directed toward the south and east, being strongest in winter (1-1.5 dyn/sq cm) and weakest in fall (0.25-0.5 dyn/sq cm). In addition to the expected increase in magnitude with increasing latitude, remarkable small-scale variability occurred. An offshore increase in stress was widespread and dominated the mid-Atlantic Bight; in winter the stress there increased from 0.5 to 1.0 dyn/sq cm in going 200 km offshore. In the Gulf of Maine and especially in the Gulf of St. Lawrence, local maxima occurred; the tail of the Grand Banks 500 km from shore showed a minimum. Probably much of the variation is associated with the intensity (and frequency) of cyclonic activity rather than directly with changes in friction at the underlying surface. Some oceanographic consequences were commented on, but the computations are intended principally as a data source for further research. (Sims-ISWS)

W77-12551

ANALYSIS OF VARIATIONS IN OCEAN COLOR,
Laboratoire de Physique et Chimie Marines, Villefranche-sur-Mer (France). Station Marine.
For primary bibliographic entry see Field 2K.
W77-12557

SURF OBSERVATIONS AND LONGSHORE CURRENT PREDICTION,
Coastal Engineering Research Center, Fort Belvoir, Va.
J. H. Balsillie.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A019 512, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum No. TM-58, November 1975. 39 p, 8 fig, 1 tab, 25 ref, 1 appendix.

Descriptors: *Pacific Ocean, *Surf, *Beaches, *Ocean waves, *Currents (Water), *California, *Geomorphology, Waves (Water), Analysis, On-site investigations, Littoral drift.
Identifiers: *Longshore currents, Breaking waves, Visual observations, Empirical analysis, Surf zone.

Simultaneous field observations of breaker and current behavior were made using techniques of the Littoral Environment Observation (LEO) program. This program is used to collect data on beach and surf conditions. The data base for this report represents a concentrated data collection effort over a period of 1 year at 3 beach sites at Point Mugu, California. Observed longshore currents were represented by the behavior of dye injected into the surf between the shoreline and breakers. Predicted longshore currents, based on the observation that longshore currents are generated primarily by waves, were estimated using a relationship for the average longshore current across the surf. The prediction model relies upon consideration of the radiation stress or wave thrust on water inside the breakers, and is evaluated using LEO breaker heights, angles of wave approach at breaking, and estimated widths of the surf zone. The degree of similarity between observed and predicted longshore currents was high. This similarity not only suggests that the relationship for prediction of longshore currents is reasonable in field situations, but that there is a high degree of internal consistency within typical LEO data sets. (Adams-ISWS)

W77-12560

AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR U.S. COAST GUARD AIRCRAFT POLLUTION PATROLS,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 5A.
W77-12562

ADAPTATION OF A GENERAL CIRCULATION MODEL TO OCEAN DYNAMICS,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
R. E. Turner, T. H. Rees, and G. E. Woodbury.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-10767, Price codes: A03 in paper copy, A01 in microfiche. Technical Note D-8258, October 1976. 38 p, 3 fig, 9 ref, 2 appendix.

Descriptors: *Ocean circulation, *Model studies, Mathematical models, Circulation, Water circulation, Equations, Formulas, Numerical analysis, Oceans, Dynamics, Hydrodynamics.
Identifiers: Filtered primitive flow.

A new primitive-variable general circulation model of the ocean was formulated in which fast external gravity waves are suppressed with rigid-lid surface constraint pressures which also provide a means for simulating the effects of large-scale, free-surface topography. The surface pressure method is simpler to apply than the conventional stream function models, and the resulting model can be applied to both global ocean and limited region situations. Strengths and weaknesses of the model were also presented. (Sims-ISWS)

W77-12563

BEACH FILL STABILITY AND BORROW MATERIAL TEXTURE,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2J.
W77-12566

THE USE OF AERIAL PHOTOGRAPHY IN THE STUDY OF WAVE CHARACTERISTICS IN THE COASTAL ZONE,
Coastal Engineering Research Center, Fort Belvoir, Va.

For primary bibliographic entry see Field 7B.
W77-12573

HUTCHINSON ISLAND: EVALUATION AS A POTENTIAL AREA OF CRITICAL STATE CONCERN.

Florida Dept. of Administration, Tallahassee. Div. of State Planning.
For primary bibliographic entry see Field 6G.
W77-12585

PRIMARY PRODUCTION AND CHLOROPHYLL CONTENT IN THE BALTIC SEA: PART II. CHLOROPHYLL-A DISTRIBUTION.

Morski Instytut Rybacki, Gdynia (Poland). Dept. of Oceanography.
For primary bibliographic entry see Field 5C.
W77-12591

MERCURY IN SHARK IN WESTERN AUSTRALIA - A PRELIMINARY REPORT.

Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
For primary bibliographic entry see Field 5B.
W77-12635

PHYSICAL MODEL OF MARINE PHYTOPLANKTON CHLORINATION AT COASTAL POWER PLANTS.

Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 5B.
W77-12645

MERCURY CONTENT OF SEVERAL PREDACIOUS FISH IN THE ANDAMAN SEA.

Chulalongkorn Univ., Bangkok (Thailand). Dept. of Marine Science.
For primary bibliographic entry see Field 5B.
W77-12652

THE TOXICITY OF AMMONIUM MOLYBDATE TO MARINE INVERTEBRATES.

University of Strathclyde, Dumbartonshire (Scotland). Marine Lab.
For primary bibliographic entry see Field 5C.
W77-12653

TRACE METALS IN FINFISH FROM THE NEW YORK BIGHT AND LONG ISLAND SOUND.

National Marine Fisheries Service, Milford, Conn. Milford Lab.
For primary bibliographic entry see Field 5B.
W77-12654

FURTHER STUDIES UPON A STEEL WORKS EFFLUENT.

University of Strathclyde, Dumbartonshire (Scotland). Marine Lab.
For primary bibliographic entry see Field 5B.
W77-12656

SURVIVAL AND GROWTH OF BIVALVE LARVAE UNDER HEAVY-METAL STRESS.

National Marine Fisheries Service, Milford, Conn. Milford Lab.
For primary bibliographic entry see Field 5C.
W77-12663

THE RELATIONSHIP BETWEEN THE SMALL ALGAL FLORA OF THE CHAIN OF SHALLOW INLETS TO THE SOUTH OF DARSS (SOUTH BALTIC) AND THE QUALITY OF THESE WATERS, (IN GERMAN).

Rostock Univ. (East Germany). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-12717

THE EFFECT OF LABORATORY CONDITIONS ON THE EXTRAPOLATION OF EXPERIMENTAL MEASUREMENTS TO THE ECOLOGY OF MARINE ZOOPLANKTON. II. EFFECT OF OXYGEN SATURATION ON THE RESPIRATION RATE.

Rosentiel School of Marine and Atmospheric Science, Miami, Fla.
For primary bibliographic entry see Field 5C.
W77-12784

UPPER BAY SURVEY, VOL. I. EXECUTIVE SUMMARY.

Westinghouse Ocean Research Lab., Annapolis, Md.
For primary bibliographic entry see Field 5B.
W77-12785

UPPER BAY SURVEY VOL. IV. NUMERICAL MODELING.

Westinghouse Oceanic Div., Annapolis, Md.
For primary bibliographic entry see Field 5B.
W77-12786

ELECTRIC FIELD RECORDING OF TIDAL CURRENTS IN THE STRAIT OF MAGELLAN.

Hawaii Inst. of Geophysics, Honolulu.
R. R. Harvey, J. C. Larsen, and R. Montaner.
Journal of Geophysical Research, Vol. 82, No. 24, p. 3472-3476, August 20, 1977. 3 fig, 2 tab, 6 ref.
NOAA-04-5-022-19.

Descriptors: *Tidal bores, *Currents(Water), *Straits, *Current meters, Tides, Electrical equipment, Electrodes, Navigation, Ships, Hazards, On-site investigations, On-site data collections, Data processing, Oceanography.

Identifiers: *Tidal currents, *Strait of Magellan, *First Narrows(Strait of Magellan), Electric fields.

The electric field in the beach along the First Narrows of the Strait of Magellan was recorded for 1 month. The observed signals correlate with direct tidal current measurements from the Narrows. As an aid to control of the heavy ship traffic through the strait, the onshore electric field was shown to be a practical real time monitor for tidal currents. (Sims-LSWS)
W77-12805

AEROSPACE RESEARCH OF THE ENVIRONMENT. GEOBOTANY, SOIL SCIENCE, AND HYDROLOGY.

For primary bibliographic entry see Field 7B.
W77-12820

PHYTOPLANKTON PRODUCTION AND DISTRIBUTION IN HOWE SOUND, BRITISH COLUMBIA: A COASTAL MARINE EMBAYMENT-FJORD UNDER STRESS.

Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
For primary bibliographic entry see Field 5B.
W77-12849

EFFECTS OF TIDAL FLUCTUATIONS OF SALINITY ON PERICARDIAL FLUID COMPOSITION OF THE AMERICAN OYSTER CRASSOSTREA VIRGINICA.

Louisiana State Univ., Baton Rouge. Dept. of Zoology and Physiology.
For primary bibliographic entry see Field 5C.
W77-12873

STUDIES ON THE TOXICITY OF CADMIUM TO THE THREE-SPINED STICKLEBACK GASTEROSTEUS ACULEATUS L.

University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5C.
W77-12874

MICROBIOLOGICAL STUDIES OF TOKYO BAY.

Tokyo Univ. (Japan). Ocean Research Inst.
For primary bibliographic entry see Field 5C.
W77-12875

POLYCHAETE SPECIES DIVERSITY AND PHYSICAL ENVIRONMENT OF SEDIMENT IN USU BAY, (IN JAPANESE).

Hokkaido Univ., Hakodate (Japan). Lab. of Marine Culture.
For primary bibliographic entry see Field 5C.
W77-12876

UPPER BAY SURVEY, VOL. II. TECHNICAL REPORT.

Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.
For primary bibliographic entry see Field 5A.
W77-12880

UPPER BAY SURVEY, VOL. III. AUTOMATED DATA PROCESSING AND SUPPLEMENTARY DATA.

Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.
For primary bibliographic entry see Field 5A.
W77-12881

CURRENT PATTERNS AND DISTRIBUTION OF RIVER WATERS IN INNER BRISTOL BAY, ALASKA.

National Marine Fisheries Service, Seattle, Wash. R. R. Straty.
NOAA Technical Report NMFS SSRF-713, June 1977. 16 p, 16 fig, 1 tab, 15 ref.

Descriptors: *Currents, *Estuaries, *Rivers, *Mixing, Hydrography, Bays, *Alaska.
Identifiers: *Bristol Bay(AK).

Hydrographic studies to determine the distribution of the waters of the major sockeye-salmon-producing river systems in inner Bristol Bay show the net seaward flow of river water is along the northwest (right) side of inner Bristol Bay. The net motion of seawater toward the head of Bristol Bay transports with it the waters of Ugashik and Egegik rivers, which enter the bay on the southeast side. Near Egegik Bay to Middle Bluff, the mixed sea and river waters join the seaward flow of Kvichak and Naknek river waters, which enter at the head of Bristol Bay. Waters of these four rivers, along with the large volume of water from the rivers entering Nushagak Bay, are eventually transported to, and move seaward on, the northwest side of Bristol Bay. Waters of Naknek, Egegik, and Ugashik rivers are similar to each other in the courses followed during ebb and flood tides. Flood tide currents, along with the nontidal current, transport water from Egegik and Ugashik rivers above or north of the entrance to Egegik and Ugashik bays. (NOAA)
W77-12910

APPLICATION OF A 'RADIATION-TYPE' BOUNDARY CONDITION TO THE WAVE-POROUS PROBLEM.

North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.
C. R. McClain, N. E. Huang, and L. J. Pietrafesa.
Sea Grant Publication No. UNC-SG-77-10, May 1977. Also as: Center for Marine and Coastal Studies Report No. 77-8. 102 p, 19 fig, 5 tab, 75 ref, 4 append. SG-04-6-158-44054.

Descriptors: *Storms, *Erosion, *Sediment transport, *Boundary processes, Shear stress, North Carolina.
Identifiers: Wave theory, Wave action, Boundary conditions.

Field 2—WATER CYCLE

Group 2L—Estuaries

Many coastal states, and in particular North Carolina, have had to address the problem of the effects of coastal sediments having been transported, usually under severe oceanic and atmospheric storm conditions. This is a study to understand the physics governing the transport of coastal sediments and of the interactive effects between the oceanic fluid and sediment media. The porous bed effects and their relative importance upon an Airy wave in 'intermediate' and 'shallow' water depths was investigated. Particular attention is directed towards the bottom boundary condition to be used, because it will have significant effects on the wave and bed flow properties, especially in the boundary layer. A large number of assumptions are made which limit practical application to a certain extent, but judicious deletion of particular terms in the equations of motion allow analytic solution of the coupled problem and clarified the influence of the boundary condition. (NOAA)
W77-12911

NUTRIENTS IN ALBERMARLE SOUND, NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W77-12912

FLOW DYNAMICS AND SEDIMENT MOVEMENT IN LOCKWOODS FOLLY INLET, NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.
J. L. Machemehl, M. Chambers, and N. Bird.
Sea Grant Publication No. UNC-SG-77-11, June 1977. Also as Center for Marine and Coastal Studies Publication No. 77-10. 150 p, 75 fig, 10 tab, 31 ref, 8 append. SG-04-6-158-44054.

Descriptors: *Sediment transport, *Inlets (Waterways), *Mathematical models, *North Carolina, Flow characteristics.
Identifiers: Flow patterns, Bypassing, Numerical simulation models, *Lockwoods Folly Inlet (NC).

A numerical simulation model for the computation of tidal and fresh water flow exchange through a coastal inlet was modified and calibrated with field data (current, water surface elevation and bottom topography) for Lockwoods Folly Inlet, N.C. The model was then used to predict the flow patterns in the inlet. A generalized hypothesis of the patterns of sediment movement through and bypassing the inlet was formulated from an evaluation of the flow data and from an analysis of the orientation and structure of the bedforms observed in the inlet and on the offshore bar. When used in conjunction with an analysis of bedform and tracer sand data the numerical simulation model was found to be a valid method of monitoring the high energy inlet environment. (NOAA)
W77-12913

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 8. COMPUTER MODELS FOR ENVIRONMENTAL ENGINEERING AND RESEARCH IN NEAR-COASTAL ENVIRONMENTS.
Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
Sea Grant Program Report No. MITSG-77-16, Index No. 77-716-Zvb, July 1, 1977. 33 p, 8 fig, 18 ref.

Descriptors: *Mathematical models, *Computer models, *Environmental effects, *Computer programs, Circulation, Dispersion.
Identifiers: *Coastal zone, Environmental engineering, Near-coastal environments.

A family of computer programs that model hydrodynamic circulation and dispersion in a body of water have been written. Using these models,

together with selected field measurements as input, it is possible to forecast where a substance (municipal sewage, for example) introduced at some point, will be transported as a result of currents driven by prevailing winds and tides. It is further possible to make predictions about concentrations of the substance at various points along its travels. These two physical processes also form the basis for developing other predictions about chemical and biological transformations that occur when a substance is introduced into near-coastal environments. Users of the MIT Sea Grant Computer Models will benefit from the exercise and debugging the models have had by application to real problems. The applications briefly outlined also suggest the range of applicability of the programs to research projects and real world problems. They represent efforts by other Sea Grant Institutions who are using the models. (NOAA)
W77-12916

FINAL ENVIRONMENTAL IMPACT STATEMENT PROPOSED ESTUARINE SANCTUARY GRANT AWARD FOR ROOKERY BAY, COLLIER COUNTY, FLORIDA TO STATE OF FLORIDA.
National Oceanic and Atmospheric Administration, Washington, D.C. Office of Coastal Zone Management.
Office of Coastal Zone Management, Final Environmental Impact Statement to State of Florida, August 29, 1977. 77 p, 3 fig, 2 tab, 4 append.

Descriptors: *Estuaries, *Wetlands, *Resources development, Water resources, *Environmental effects, *Baseline studies, *Florida, Recreation, Economics, Coasts, Public benefits.
Identifiers: *Coastal zone management, *Sanctuaries, *Environmental impact, Resources management, Nursery grounds.

The acquisition and operation of the estuarine sanctuary would primarily serve to maintain the long-term natural integrity of the Rookery Bay estuarine system. Negative impacts are potential conflicts between sanctuary and adjacent owners in terms of drainage projects, mosquito control activities, and restrictions imposed by scientific research which conflicts with traditional users. The most apparent adverse economic impact will be tax revenue loss which, in part, will be offset by acquiring and operating lands. The sanctuary will benefit the area by maintaining a major unspoiled area of coastal wetlands that are a scenic and recreational amenity to the residents of Naples and Collier County. It will protect an essential breeding, feeding and nursery ground of marine and birdlife that provide food, recreation and beauty. The research conducted will help guide the State, industry and individuals in the proper conservation and management of its coastal and marine resources. The clean, unspoiled atmosphere of the area should increase the economic value of developed and developable real estate in the Naples area which should offset the potential loss of tax revenues. (NOAA)
W77-12957

PREDICTION OF LITTORAL DRIFT FOR LAKES AND BAYS FROM WIND OBSERVATIONS,
Florida Univ., Gainesville. Dept. of Civil Engineering; and Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2J.
W77-12958

STATE OF CALIFORNIA COASTAL MANAGEMENT PROGRAM AND FINAL ENVIRONMENTAL IMPACT STATEMENT.
National Oceanic and Atmospheric Administration, Washington, D.C. Office of Coastal Zone Management; and California Coastal Zone Conservation Commissions, San Francisco.

NOAA, Office of Coastal Zone Management and California Coastal Commission, Final Environmental Impact Statement on California Coastal Management Program (1977). 395 p.

Descriptors: *Coasts, *Management, Water resources, *Resources development, *Environmental effects, *Legislation, *Regulation, *California, Economics, Quality control, Land use.
Identifiers: *Coastal zone management, *Environmental impact, Resources management.

The second segment of a two segment program proposes Federal approval of the California Coastal Management Program. The San Francisco Bay segment was approved on February 16, 1977. Approval would initiate implementation of the program under the CZMA, although the program is currently implemented through State funds, allowing Federal administration grants to be awarded to the State, and require that Federal actions be consistent to the maximum extent practicable with the approved program. Approval and implementation of the program will provide California with funding that will restrict or prohibit certain land and water uses in parts of the California coast, while promoting and encouraging development and use activities in other parts. This may affect property values, property tax revenues, and resource extraction or exploration. The program will provide an improved decision-making process for determining coastal land and water uses and siting of facilities of national interest, and will lead to increased long-term protection of and benefit the State's coastal resources. (NOAA)
W77-12959

CONCEPTUAL DESIGN OF A COMPUTER SYSTEM TO SUPPORT THE OPERATIONS OF THE SUBMERGED LANDS SECTION UNDER ACT 247 AND ACT 346.
American Management Systems, Inc., Arlington, Va.; and Michigan Dept. of Natural Resources, Lansing. Bureau of Water Management.
For primary bibliographic entry see Field 7C.
W77-12961

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL TECHNICAL SUMMARY REPORT.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-12963

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS. OCTOBER-DECEMBER 1976. VOLUME 1: RECEPTORS (BIOTA): MARINE MAMMALS; MARINE BIRDS; MICROBIOLOGY.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-12964

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS. OCTOBER-DECEMBER 1976. VOLUME 2: RECEPTORS (BIOTA): FISH; PLANKTON; BENTHOS; LITTORAL.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-12965

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS. OCTOBER-DECEMBER 1976. VOLUME 4: HAZARDS; DATA MANAGEMENT.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

For primary bibliographic entry see Field 6G.
W77-12966

LIPOLYTIC ENTEROBACTERIA OF THE ODESSA BAY LITTORAL ZONE, (IN UKRANI-AN),

Institute of Biology of the Southern Seas, Odessa (USSR).

For primary bibliographic entry see Field 5C.
W77-12974

HYDROBIOLOGICAL RESEARCH RELATED TO LARGE SCALE EXPERIMENTAL POLLUTION STUDIES IN THE RANCE ESTUARY: PRIMARY PRODUCTION IN RELATION TO CERTAIN PHYSICO-CHEMICAL PARAMETERS, (IN FRENCH),

Museum National d'Histoire Naturelle, Paris (France). Laboratoire de Physiologie Generale et Comparee.

For primary bibliographic entry see Field 5C.
W77-12975

PRELIMINARY ANALYSIS ON THE DISTRIBUTION OF PORIFERA IN AREAS EXPOSED TO DIFFERENT TYPES OF POLLUTION, (IN ITALIAN),

Genoa Univ. (Italy). Inst. of Zoology.

For primary bibliographic entry see Field 5B.
W77-12976

ZOOPLANKTON OF THE DNIESTER ESTUARY AND ADJACENT SEASIDE UNDER ANTHROPOGENIC INFLUENCES, (IN RUSSIAN),

Institute of Biology of the Southern Seas, Odessa (USSR).

For primary bibliographic entry see Field 5B.
W77-12977

STUDIES ON COASTAL OCEANOGRAPHY IN TANOURA BAY, IZU PENINSULA (1975-1974), (IN JAPANESE),

Nihon Univ., Tokyo. Coll. of Agriculture and Veterinary Science.

For primary bibliographic entry see Field 5B.
W77-12980

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CALIFORNIA'S WATER RECLAMATION AND DESALINATION PROJECTS,

California State Dept. of Water Resources, Sacramento.

For primary bibliographic entry see Field 5D.
W77-12295

STATUS OF SEA WATER REVERSE OSMOSIS MEMBRANE PROCESS TECHNOLOGY,

Office of Water Research and Technology, Washington, D. C.

K. C. Channabasappa, and J. J. Strobel.

In: Proceedings of the Fifth International Symposium on Fresh Water from the Sea, Volume 4. Symposium held May 16-20, 1976, Athens (Greece), p 267-291, 1976. 12 fig, 5 tab, 15 ref.

Descriptors: *Reverse osmosis, *Desalination processes, *Membrane processes, *Reviews, Saline water, Osmosis, Separation techniques, Technology, Methodology, Sea water, Costs, Unit costs, Operating costs, Membranes, Desalination apparatus, Thin films, Brackish water.
Identifiers: Plugging index.

This paper described the present status (1976) of the seawater reverse osmosis desalination technology developed by the Department of the Interior. Both cellulosic and non-cellulosic membranes capable of seawater conversion to potable water in one-pass were developed. A recent and most promising development is the thin-film composite membrane. Membrane modules with diameters up to 8 in with desalting capacities up to 5000 gallons per day have been tested in pilot plants for over 1 year. Results indicate that all of the membrane systems are suitable for seawater desalination at operating pressures of 800-1000 psi. Cost estimates indicate that reverse osmosis is more economical than distillation. (Humphreys-ISWS)
W77-12571

HISTORY, STATUS AND FUTURE OF DISTILLATION PROCESSES,

Watson Desalination Consultants, Manassas, Va. B. M. Watson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 005. Price codes: A08 in paper copy, A01 in microfiche. Completion Report, December 1976. 147 p, 12 fig, 12 tab, 62 ref, 3 append. OWRT T-0005(6704)(1), 14-34-0001-6704.

Descriptors: *Reviews, *Desalination processes, *Distillation, *Membrane processes, Technology, Operating costs, Desalination plants, Water treatment, Waste water treatment.
Identifiers: *Technology transfer.

Distillation processes and materials for marine and power station water supply, pharmaceuticals, bottled water, chemicals and food processing, by-product recovery and industrial and utility waste stream concentration are adequately developed and economically viable. Further improvements are and will be effected by normal commercial competitive effort. The membrane processes will be far more economical for salt reduction than distillation, except for water recovery from geothermal brines or processing of highly saline waters for mineral recovery. Current and future markets for distillation processes will continue to be for municipal and industrial water supply to coastal regions and islands. This market is estimated to reach a total installed capacity, by the year 2000 of 1635 MGD with current technology improved by normal course of commercial competition. A technology optimization program achieving water cost reduction to the level of \$1.50/kgal at 50 MGD-size, and improvement of current plant factors from 50-60 percent to 85 percent, would result in an estimated installed capacity of 2500 MGD by 2000 A.D.
W77-12631

STATE-OF-THE-ART OF MEMBRANE AND ION EXCHANGE DESALTING PROCESSES,

Hittman Associates, Inc., Columbia, Md.

H. M. Curran, D. Dykstra, and D. Kenkeremath.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 034. Price codes: A11 in paper copy, A01 in microfiche. Final Report HIT-658, November 1976. 212 p. 44 fig, 30 tab, 78 ref, 2 append. OWRT T-0007(6705)(1).

Descriptors: *Reviews, *Desalination processes, *Electrodialysis, *Ion exchange, *Reverse osmosis, Technology, Desalination apparatus, Desalination plants, Water treatment, Waste water treatment.
Identifiers: *Technology transfer.

The state-of-the-art for three desalting processes is presented. These are the reverse osmosis, electrodialysis, and ion exchange processes. Each process is discussed with respect to historical background, process description and current state-of-the-art. Also included are discussions of operating problems and an assessment of potential markets for these types of desalting equipment. Membrane desalting processes have reached the point of commercial acceptability as demonstrated by many operating plants, particularly in the municipal, industrial, and power plant areas. The total installed capacity of membrane desalting plants is still relatively small. Ion exchange desalting is economically competitive with membrane processes only at salinities of a few hundred ppm. Consequently the total installed ion exchange desalting capacity is very small. The desalting technology originally developed for saline water conversion can be transferred to various other water management applications, such as water reuse, water recycling, and pollution control. Growth of the membrane desalting market in the U. S. and nearby islands will increase at a rate greater than that of the general economy. Assuming a 20 percent growth rate, the number of plants would increase from about 200 in 1975 to about 1700 at the end of 1986. Government support in both areas of research and development to the private sector can accelerate market acceptance of desalting technologies by helping to remove the technological barriers to market penetration.
W77-12632

THE PRODUCTION OF WATER FROM GEOTHERMAL RESERVOIRS: SOME ECONOMIC CONSIDERATIONS,

California Univ., Riverside. Dept. of Soil and Environmental Science.

H. J. Vaux, Jr.

Water Resources Bulletin, Vol 13, No 3, p 469-478, June, 1977. 2 tab, 19 ref.

Descriptors: *Thermal water, *Brines, *Desalination, *Costs, Geothermal studies, Water supply, Pricing, Water values, Brine disposal, Distillation, Electrodialysis, Thermal power.

Liquid dominated geothermal systems are expected to account for most of the growth in geothermal energy production in the coming decades. Production of usable water from thermal systems could significantly augment fresh water supplies in the vicinity of these systems, however, serious potential problems relating to seismic impacts, land subsidence, and quality of geothermal brines place doubt on the feasibility of large-scale mining and treatment of thermal waters. Should all technical difficulties of this nature be overcome, desalination processes may well be possible. It then remains to be seen if the high cost of producing and delivering water from geothermal systems could be borne by the prospective users. At an estimated \$162 per acre foot, the price of such water is far above the upper range of water value for any type of use in the U.S. today. It is suggested that efforts to meet increasing water demands through exploitation of geothermal systems may well be more economically and efficiently directed toward more effective allocation and development of existing conventional water supply sources. (Eberle-NWNA)
W77-12682

INTEGRATING DESALINATION AND AGRICULTURAL SALINITY CONTROL TECHNOLOGIES,

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.

W. R. Walker.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 71-94. 7 fig, 3 tab, 11 ref.

Descriptors: *Salinity, Water quality, *Return flow, Seepage, *Desalination, Optimization, *Colorado, Economics.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

In viewing salinity management on a regional basis, the strategies for improving the quality of irrigation return flows are important considerations. Alternatives for reducing salinity in these flows include traditional treatments like conveyance channel linings to eliminate seepage as well as new technologies such as desalination. A general approach is presented for determining the optimal use of both measures and is demonstrated with a case study applied to Colorado's Grand Valley. Relationships descriptive of irrigation conveyance linings and desalination using a reverse osmosis process are combined with anticipated salinity reductions in return flows entering the Colorado River. The resulting cost-effectiveness functions are then optimized to determine the best use of either technology for salinity control. Results indicate that linings, and probably other agricultural treatments as well, exhibit increasing marginal costs with scale. Desalting costs show a reverse trend. These findings imply that most salinity control in the early stages of implementation will involve agricultural measures almost exclusively. At later stages or higher levels of desired salinity reduction desalting will play an increasingly important role. The methodology presented and the results of the case study demonstrate the procedures for delineating the magnitudes of either technology's application. (See also W77-12726) (Skogerboe-Colorado State) W77-12761

DESALINIZATION OF A HIGHLY SALINE SOIL, PREDICTION AND FIELD OBSERVATION,

Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use.

J. W. van Hoorn, J. Risseuw, and J. M. Jurado Prieto.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 558-574, 6 fig, 5 tab, 4 ref.

Descriptors: *Desalination, *Saline soils, Hydraulic conductivity, Soil properties, Leaching, Drainage, Forecasting.
Identifiers: *Spain(Quadalquivir River).

On the Marismas soils of the right bank of the Quadalquivir River in Southern Spain an experimental farm was set up to provide detailed information for the future reclamation and development of this area. The desalination was calculated assuming leaching by rainfall. Since the drains are located on an impermeable layer, the leaching process was calculated by a numerical method assuming a decrease of the amount of percolation water with depth. This desalination is slower than the one calculated for the drains located well above an impermeable layer, assuming all the water percolating through the soil profile until drain depth. (See also W77-12726) (Skogerboe-Colorado State) W77-12762

USE OF REVERSE OSMOSIS FOR VALUABLE BY-PRODUCTS RECOVERY,

Office of Water Research and Technology, Washington, D.C.
K. C. Channabasappa.
Chemical Engineering Progress Symposium Series, Vol. 67, No. 107, p 250-259, 1970. 12 fig, 10 tab.

Descriptors: *Reverse osmosis, *Byproducts, *Waste water treatment, Technology, *Membrane processes, Costs, Capital costs, Operating costs, Industrial wastes, Organic wastes, Chemical wastes, Steel, Iron, Pulp wastes, Sulfite liquors, Food processing industry, Application methods, *Water reuse, Desalination, *Desalination processes, Brackish water.
Identifiers: Food processing.

A preliminary survey of 18 industries was made to determine the economic potential of by-product

recovery. The following 6 industries were found to offer the most potential: cheese, paper and pulp, organic chemicals, nuclear, iron and steel, and plating. Because of the type of raw materials used and product mix produced, these industries also contribute the largest amount of industrial pollution load. Since by-product recovery involves solute-solvent separation, membrane processes appear to be most suitable for this application. Of the two leading membrane processes, reverse osmosis is better suited than electrodialysis. Though the present technology reverse osmosis membranes and equipment are suitable for certain wastes, new families of membranes and equipment designs are needed to improve the economics of by-product recovery. Besides by-products, an important economic incentive in using reverse osmosis for industrial waste treatment is the recovery of water for plant reuse. In some locations, the cost of recovered water will equal or exceed the operating cost of a reverse osmosis plant. In summary, it is believed that the reverse osmosis process offers an excellent tool for industry to meet the challenge of pollution control in the seventies. (Humphreys-ISWS) W77-12795

WATER IN KUWAIT,

Durham Univ. (England). Dept. of Geography.

P. Beaumont.

Geography (London), Vol. 62, No. 3, p 187-197, July 1977. 2 fig, 5 tab, 32 ref.

Descriptors: *Water supply, *Arid lands, *Water resources, *Desalination, *Water resources development, Water treatment, Saline water, Saline water systems, Brackish water, Water rates, Water sources, Deserts, Desalination plants, Flash distillation, Desalination apparatus, Pricing, Rationing(Water).
Identifiers: *Kuwait.

Kuwait is one of the most arid countries in the world. The lack of water resources has meant that agricultural production has been very restricted. With development of the petroleum industry there has been a rapid growth and urbanization of the population. As a result, the demand for water has increased. The water resources, water supply, and development of water supply in Kuwait are discussed. The government of Kuwait has been involved since the 1950's in the desalination of sea water using combined electricity generating and flash distillation plants. This program, along with the utilization of fresh and brackish groundwater, has considerably eased the water supply situation. With continued growth, however, further pressures will be placed upon the available water resources. An alternative strategy may be the introduction of a water pricing policy which discourages wasteful use. Some form of water rationing is also discussed. (Jamail-Arizona) W77-12837

3B. Water Yield Improvement

SEASONAL USE OF SOIL WATER BY MATURE VELVET MESQUITE,

Rocky Mountain Forest and Range Experiment Station, Albuquerque, N. Mex.

D. R. Cable.

Journal of Range Management, Vol 30, No 1, p 4-11, January, 1977, 7 fig, 1 tab, 10 ref.

Descriptors: *Mesquite, *Soil water, *Root zone, *Range management, *Soil water movement, *Consumptive use, Seasonal, Phreatophytes, Moisture, Precipitation(Atmospheric), Rainfall, Arid lands, Recharge, *Arizona, Vegetation effects, Competition, Root systems, Plant growth, Soil-water-plant relationships, Available water.
Identifiers: Tucson, Santa Rita Experimental Range.

Velvet mesquite competes actively with perennial grasses for soil water. When mesquite is killed or reduced in numbers, perennial grass production increases. A study was undertaken near Tucson, Arizona to determine the water use pattern of mature velvet mesquite at all stages in the annual growth cycle within a soil mass six meters deep and extending fifteen meters horizontally beyond the edge of the tree crowns. The data collected are presented. Conclusions include: (1) winter precipitation is much more effective in recharging the soil profile than is summer precipitation; (2) soil water is extracted most rapidly where and when available soil water is highest; (3) essentially all available soil water from winter recharge is used before the end of the May-June drought, except in years when winter precipitation is appreciably higher than the long-time mean; (4) stage of growth of mesquite during the leaf-bearing period has little effect on rates of soil water extraction; (5) evaporation affects losses primarily at the 25 centimeter depth, and to a much lesser extent at the 50 centimeter depth; (6) the competitive effect between mesquite and grasses is more severe in dry years than in wet years. (Jamail-Arizona) W77-12283

ROOT SYSTEM OF SHRUB LIVE OAK: IMPLICATIONS FOR WATER YIELD IN ARIZONA CHAPARRAL,

Rocky Mountain Forest and Range Experiment Station, Tempe, Ariz.

E. A. Davis, and C. P. Pase.

Journal of Soil and Water Conservation, Vol. 32, No. 3, p 174-180, July-August, 1977, 3 fig, 3 tab, 20 ref.

Descriptors: *Root systems, *Soil-water-plant relationships, *Arizona, *Chaparral, *Consumptive use, *Watershed management, Shrubs, Arid lands, Desert plants, Soil water, Soil moisture, Water yield, Water yield improvement, Root zone, Drought tolerance, Brush control, Brush, Root development.
Identifiers: Live oak.

Shrub live oak is the dominant species in much of Arizona's chaparral. The root system of a typical plant was studied thoroughly by quantitatively determining root mass distribution vertically and laterally, followed by further excavation and examination of the root system's central section. The results are interpreted as they relate to watershed management, and presented. Roots were found in every cubic foot of soil. The greatest accumulation of root mass occurred beneath the root crown, the zone occupied by the taproot. Distribution of root mass in the other transections followed the same trend; root mass generally decreased with lateral and vertical distance from the root crown. The results also indicate that all chaparral shrubs are not equally rooted. It is thus necessary to develop a classification system of chaparral shrubs that includes water use characteristics, type and depth of root system, susceptibility to single and repeated burns, response to herbicides, sprouting ability, and browse value. (Jamail-Arizona) W77-12287

SOIL MOISTURE REDISTRIBUTION AS AFFECTED BY THROUGHFALL AND STEMFLOW IN AN ARID ZONE SHRUB COMMUNITY,

Queensland Dept. of Primary Industries, Charleville (Australia). Charleville Pastoral Lab.
For primary bibliographic entry see Field 21.
W77-12290

WATER RELATIONS AND PHOTOSYNTHESIS OF A DESERT CAM PLANT, AGAVE DESERTI,

California Univ., Los Angeles. Dept. of Biology.
For primary bibliographic entry see Field 2D.
W77-12292

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Use Of Water Of Impaired Quality—Group 3C

LIVING FENCEROWS OF THE RIO SAN MIGUEL, SONORA, MEXICO: TRADITIONAL TECHNOLOGY FOR FLOODPLAIN MANAGEMENT,

Arizona Univ., Tucson. Dept. of Plant Sciences. G. P. Nabhan, and T. E. Sheridan. Human Ecology, Vol. 5, No. 2, p 97-111, June, 1977, 7 fig, 18 ref.

Descriptors: *Flood control, *Flood plains, *Erosion control, *Sediment control, *Phreatophytes, *Mexico, Ecology, Environmental control, Cottonwoods, Arid lands, River basins, Riparian waters, Southwest U.S., Agricultural watersheds, Watershed management, Riparian plants, Trees, Willow trees. Identifiers: *Ethnobotany, *Fencerows, Rio San Miguel, Sonora.

In southwestern North America, agriculture is limited by both arable land and available water supplies. In the upper Rio San Miguel, as well as in other narrow river valleys of eastern Sonora, Mexico, floodplain farming is dependent upon living fencerows for its environmental stability. These fencerows are of cottonwood and willows, large water consumers used in this area of scarce water with positive results. The propagation, purpose, and success of living fencerows in this region are discussed in detail. The fencerows, also called 'woven fences' or 'branch fences,' are the only measure the San Miguel farmers have taken to protect their floodplain fields from erosion caused by floods. The fencerows also aid in sediment control and in fertilization, and they have enabled the farmers to preserve and even expand their arable land bases. Additional benefits, including provision of firewood and protection for animals, are discussed. (Jamail-Arizona) W77-12293

USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center; and Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management. A. M. Kahan.

Available from the National Technical Information Service, Springfield, VA 22161 as E77-10003. Price codes: A02 in paper copy, A01 in microfiche. Type III Final Report, December 30, 1974-December 30, 1975, February 28, 1976. 116 p, 19 fig, 13 tab, 5 ref, 4 append. Bu Rec 23030.

Descriptors: *Remote sensing, *Colorado River Basin, *Weather modification, Data collections, Weather data, History, Data storage and retrieval, Computers, Data processing, Satellites(Artificial), Meteorology.

Identifiers: LANDSAT, San Juan Mountains(Co).

The final report documented the results of a 12-month LANDSAT follow-on investigation which ended December 30, 1975. During the investigation, the LANDSAT DCS (data collection system) was used to relay data from remote, unattended field sites in the severe winter environment of the San Juan Mountains of southwest Colorado. The objectives for the investigation emphasized the operational use of the LANDSAT DCS in the Bureau of Reclamation's Colorado River Basin weather modification program and the continued evaluation of the LANDSAT DCS from a user's viewpoint. An electronic wind data averaging system was developed to improve the LANDSAT system's usefulness by providing a history of averaged wind speed and wind direction data. Field testing of the wind averaging system demonstrated the feasibility of transmitting averaged wind data, stored over a period of several hours, from a remote site. This investigation has shown that the LANDSAT DCS's (data collection platforms) are reliable, weather resistant, and cost-effective units. Data from the LANDSAT DCS were available in near real time to aid in the daily opera-

tional decision, to quality check system performance, and to schedule special maintenance trips into remote areas. Further research should place continued emphasis on the development and application of the LANDSAT DCS for operational use. (See also W77-02500) (Froehlich-ISWS) W77-12329

POTENTIAL WATER YIELD RESPONSE FOLLOWING CLEARCUT HARVESTING ON NORTH AND SOUTH SLOPES IN NORTHERN IDAHO,

Intermountain Forest and Range Experiment Station, Ogden, Utah. For primary bibliographic entry see Field 4C. W77-12366

WELL REDEVELOPMENT: PART I,

North Water Well Association, Worthington, Ohio. For primary bibliographic entry see Field 8B. W77-12673

WORKSHOP FOR AN ASSESSMENT OF THE PRESENT AND POTENTIAL ROLE OF WEATHER MODIFICATION IN AGRICULTURAL PRODUCTION,

Colorado State Univ., Fort Collins. Dept. of Atmospheric Science. L. O. Grant, and J. D. Reid.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 633. Price codes: A11 in paper copy, A01 in microfiche. Report CSU ATSP-236, August 1975. Compilation of materials for a workshop held at Ft Collins, Colorado, July 15-18, 1975. 241 p. NSF 31-1371-2845.

Descriptors: *Weather modification, *Agriculture, *Conferences, Precipitation(Atmospheric), Rainfall, Hail, Snowfall, Clouds, Evaluation, Cloud seeding, Cloud physics, Effects, Crops, Legal aspects, Benefits, Risks, Meteorology.

The workshop was organized and conducted to identify the needs of agriculture and the capabilities and risks of weather modification. The report is a compilation of the workshop materials. Many weather modification effects were considered: changes in precipitation, hail suppression, storm abatement, wind reduction, temperature modification, cirrus cloud production, fog production, change in surface albedo, orchard heating, lightning suppression, etc. Areas where weather changes would be beneficial to agriculture were also identified: additional rainfall, reduced rainfall, a change in rainfall frequency, less hail, less wind, longer growing season, lower maximum temperatures, higher or lower minimum temperatures, earlier (later) spring soil heating, etc. Consideration included the broad spectrum of agricultural and other renewable resource production and problems: crops, range and livestock, forestry, disease, weed and insect control, soils, plant nutrients, and environmental stresses. Interpretations and judgements were made in an attempt to describe the portion of weather modification research that offers the most practical and economic solutions to agricultural problems. (Sims-ISWS) W77-12816

3C. Use Of Water Of Impaired Quality

SULFATE SALINE WATER AND ITS INFLUENCE ON SELECTED AQUATIC VERTEBRATES,

North Dakota State Univ., Fargo. Dept. of Zoology. J. W. Gerst.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 635,

Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Research Report No. WI-221-040-76, July 1977. 13 p, 3 tab, 1 fig, 26 ref. OWRT A-042-NDAK(1), 14-31-0001-4034.

Descriptors: Biological membranes, Electrolytes, Fish, Ion transport, Physiological ecology, *Rainbow trout, Saline lakes, *Salinity tolerance, Sodium chloride, *Sulfates, *North Dakota, Saline water, Dissolved solids.

The successful reproduction and growth of fish in North Dakota's saline waters is determined in part by the apportionment of dissolved salts. Trout were acclimated for 1 month at 14C in dilutions of natural saline water having sulfate ion levels of 2000, 4000 and 6000 mg/l. Survival of trout in the latter 2 media was poor. The addition of Ca²⁺ ions in the form of CaCl₂ at a rate sufficient to increase calcium levels to 0.5 percent of the total dissolved solids permitted survival of trout in the 6000 mg/l SO₄(2-) medium. Trout acclimated to 6000 mg/l SO₄(2-) + Ca²⁺ supplemented medium exhibited a decrease in branchial (Na⁺ + K⁺)-stimulated MgATPase activity and an increase in the plasma sodium ion concentration. These changes were significantly different at the 5 percent level of probability when compared to the trout acclimated to the 2000 mg/l SO₄(2-) + Ca²⁺ medium. No significant difference in body weight, body length or blood hematocrit was associated with saline acclimation to the varied sulfate levels. W77-12259

COMPLETION REPORT ON CONTRIBUTION OF FERTILIZERS TO WATER POLLUTION,

Rutgers - The State Univ., New Brunswick, N. J. Dept. of Soils and Crops. For primary bibliographic entry see Field 5B. W77-12264

MODIFICATION OF A CALCAREOUS SODIC SOIL AS AFFECTED BY LEACHING WITH SALINE WATER,

Central Soil Salinity Research Inst., Karnal (India). R. C. Mondal. Annals of Arid Zone, Vol. 16, No. 1, p 39-44, March, 1977. 2 fig, 1 tab, 11 ref.

Descriptors: *Land reclamation, *Calcareous soils, *Alkaline soils, *Leaching, Saline water, Sodium, Sodium compounds, Salts, Hydraulic conductivity, Calcium, Infiltration, Magnesium, Groundwater, Soil structure, Electrolytes.

Research has indicated that the low hydraulic conductivity characteristic of a sodic soil is increased through leaching with highly saline water of low SAR value. In this study high salt content water was used to leach a sodic soil to determine quantitatively the extent of reclamation. The results are reported. Non-replicated leaching tests were carried out in brass cores filled with sodic soil. The soil was leached with four different waters of varying electrolyte concentration and the hydraulic conductivity calculated. Leaching was stopped at equilibrium condition when the composition of the leachates remained the same as that of the leaching solution and the soil in the core was made salt free by washing with 60 percent alcohol and analyzed for exchangeable sodium, calcium, and magnesium. The results show that the exchangeable sodium content of the soil was reduced from 9.62 to 1.50 me/100 grams when leached with waters having 40-80 me/l of salt. Thus, irrigation water high in salt content and SAR value can also work well to reclaim the sodic soil with gypsum or any other easy source of calcium which could lower the SAR of the saline irrigation water. (Jamail-Arizona) W77-12277

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C—Use Of Water Of Impaired Quality

SALT SIEVING WITHIN CLAY SOIL AG-GREGATES,
Commonwealth Scientific and Industrial Research
Organization, Canberra (Australia). Div. of Soils.
For primary bibliographic entry see Field 2G.
W77-12278

**EFFECT OF A SALINE AND ALKALINE
GROUND WATER ON SOIL GENESIS IN
SEMIARID SOUTHERN IRAN,**
Pahlavi Univ., Shiraz (Iran). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-12280

**USE OF SALT WATERS FOR REDUCING ESP
IN HEAVY-TEXTURED ALKALI SOILS,**
Ministry of Agriculture, Cairo (Egypt). Soils and
Water Research Inst.
M. El Hakim, H. Bakhathi, Sh. Milad, and F. B.
Moustafa.
Agricultural Research Review (Cairo), Vol. 54,
No. 4, p 45-54, April, 1976. 1 fig, 3 tab, 15 ref.

Descriptors: *Land reclamation, *Leaching,
*Alkaline soils, *Saline water, *Soil water move-
ment, *Ion transport, Reclamation, Soil proper-
ties, Soil physical properties, Soil types, Sodium
chloride, Soil water, Soil Chemistry, Soil chemical
properties, Gypsum, Arid lands, Water properties,
Soils, Cations, Cation exchange, Anions, Anion
exchange, Sodium, Adsorption, Alluvium, Salts,
Soils.
Identifiers: *Exchangeable Sodium Percentage,
Nile River, Egypt.

A laboratory experiment was conducted to deter-
mine the relative efficiency of highly saline water
compared to salt-free water in reducing the
exchangeable sodium of gypsified alkali soils. A
Nile alluvium heavy textured soil was treated with
Na₂CO₃ solutions to obtain three sodic soils with
exchangeable Na percentages of 29.6, 46.1, and
72.0. The soils were mixed with gypsum to reduce
exchangeable sodium percentage (ESP) to 10. Each
received 4 leaching treatments using salt-waters
containing NaCl and MgCl₂ (3:1) and distilled
water, and 1 treatment using distilled water exclu-
sively. Treatments consisted of a different number
of successive leaching steps using a fixed volume
of the appropriate water with initial concentrations
of 700, 350, 175, and 87.5 mg/l in the first salt
water treatment, then diluted in successive steps,
with distilled water used at the final step. With
some exception for the low sodic soil using the two
highest concentrations, the ESP values at the first
step showed a marked reduction in all treatments
irrespective of the initial concentration of the
leaching water. Upon subsequent steps a progres-
sive decrease proceeded, though at a much
reduced rate. Final ESP values were lower for all
salt-water treatments than for diluted water treat-
ments. Leaching which began with the two lowest
initial concentrations proved more efficient than
using only diluted water, and less harmful for low
sodic soil than leaching with the two highest initial
concentrations. (Ullery-Arizona)
W77-12281

**EFFECT OF SALINITY AND N-FERTILIZA-
TION ON GROWTH AND N CONTENT OF
CORN,**
Ministry of Agriculture, Cairo (Egypt). Soils and
Water Research Inst.
H. K. Bakhathi, M. El-Sawaby, S. K. Ata, and T.
Sheta.
Agricultural Research Review (Cairo), Vol. 54, No
4, p 1-5, April, 1976, 2 tab, 13 ref.

Descriptors: *Salinity, *Fertilization, *Crop
response, *Saline water, *Nitrogen, *Corn, Crop
production, Arid lands, Irrigation, Irrigation ef-
fects, Growth stages, Plant growth, Salt tolerance,
Salinity tolerance, Germination, Sodium com-
pounds, Calcium compounds, Ammonium com-
pounds, Nitrates.
Identifiers: *Egypt.

A study was conducted to determine the interac-
tion between salinity and nitrogen fertilization and
their effect on corn plants. Experiments were car-
ried out in Egypt. Early American corn seeds were
planted and irrigated with tap water and saline
water. Nitrogen in the form of ammonium sulphate
or calcium nitrate was applied. The results are
presented and show that using saline irrigation
water restricted plant growth. The dry matter yield
of the unfertilized plants decreased with the appli-
cation of saline water. Applying nitrogen fertil-
izers assisted in overcoming salinity effects. Under
saline conditions, the amount of nitrogen
taken up from calcium nitrate was higher than that
from ammonium sulphate throughout all stages.
(Jamail-Arizona)
W77-12284

**IRRIGATION OF A SALINE-SODIC SITE IN
THE SUDAN GEZIRA. I-WATER MOVEMENT,**
Gezira Agricultural Research Station, Wad
Medani (Sudan).
O. A. A. Fadl, and M. A. Ali.
Tropical Agriculture, Vol. 54, No. 2, p 157-165,
April, 1977, 3 fig, 2 tab, 5 ref.

Descriptors: *Salinity, *Soil water movement,
*Saline soils, Montmorillonite, Clays, Soil types,
Irrigation, Capillary water, Moisture content, Arid
lands, Salts, Gypsum, Sodium compounds, Sodium,
Soil moisture, Irrigated land, Alkaline soils.
Identifiers: *Sudan, *Gezira.

The future of irrigation of the heavy montmoril-
lonitic and cracking clay soils of the Gezira,
Sudan, has been the subject of a number of publi-
cations, some of which concluded that successful
irrigated farming necessitated the installment of a
drainage system to remove sodium and other salts.
Other studies have challenged these conclusions.
This work is a more detailed study than has been
undertaken so far in order to resolve the questions
of the movement of both water and salts through
the Gezira soil. The resolution of this question is
important to plans to utilize a large portion of this
land for agricultural production. Electrical con-
ductivity and exchangeable sodium percentages
were measured and intensive comparisons of
moisture profiles showed that the soil continued to
take up water as long as free water was maintained
on the surface and a hydraulic potential existed
within the profile. Uptake of water, however,
slowed down progressively with time. (See also
W77-12286) (Jamail-Arizona)
W77-12285

**IRRIGATION OF A SALINE-SODIC SITE IN
THE SUDAN GEZIRA. II-SALT MOVEMENT
AND SODICITY CHANGES,**
Soil Survey Administration, Wad Medani (Sudan).
M. A. Ali, and O. A. A. Fadl.
Tropical Agriculture, Vol. 54, No. 3, p 279-283,
July, 1977, 3 fig, 7 ref.

Descriptors: *Irrigation effects, *Soil water move-
ment, *Alkaline soils, *Saline soils, *Land recla-
mation, Alfalfa, Arid lands, Soil moisture, Sodium
compounds, Salts, Irrigation, Soil profiles, Crops,
Carbonates, Bicarbonates, Clays, Sulfates.
Identifiers: *Sudan, *Gezira, Blue Nile.

Experiments were conducted in the Sudan Gezira
in an attempt to reclaim land of impaired quality.
The area is one of high salinity where most of the
good lands have already been brought into produc-
tion. Any expansion of agriculture will have to be
on lands with high sodic and saline contents. The
experiments involved observations of salt move-
ment in the area of the Gezira where a fruit and
vegetable garden is planned. Two small plots were
selected, irrigated with water from the Blue Nile,
and planted with alfalfa. This crop was chosen for
its moderate tolerance to salinity and ability to
furnish the farmer with some returns while the
land was being reclaimed. Composite auger sam-
ples were collected in 10 centimeter steps at dif-

ferent dates for one of the two plots. Soluble salts
were determined. Exchangeable sodium percentage
was investigated while the chlorides, carbonates
and bicarbonates were directly measured in the ex-
tract and the sulphates were obtained by dif-
ference. The results are presented and show that
irrigation with Blue Nile Water and cropping with
alfalfa caused a net downward movement of salts.
(See also W77-12285) (Jamail-Arizona)
W77-12286

**EFFECT OF IRRIGATION REGIME UNDER
SALINE CONDITIONS ON GROWTH AND
YIELD OF COTTON PLANT IN CALCAREOUS
SOIL,**
Ministry of Agriculture, Cairo (Egypt). Soils and
Water Research Inst.
N. F. Soliman, I. M. Anter, M. F. Soliman, and H.
K. Bakhathi.
Agricultural Research Review (Cairo), Vol. 54,
No. 4, p 91-96, April, 1976. 2 fig, 1 tab, 12 ref.

Descriptors: *Salinity, *Irrigation effects, *Crop
response, *Crop production, *Cotton,
*Calcareous soils, Water properties, Irrigation, Ir-
rigation water, Saline water, Salts, Water quality,
Soil types, Saline soils, Soils.
Identifiers: *Egypt.

Salinity is a major problem in many irrigated areas
of Egypt. A study was conducted using a
completely randomized design with three
replicates to evaluate the effect of soil salinity and
time of irrigation on cotton growth and yield in cal-
careous soil. The results presented show that soil
salinity as well as irrigation intervals significantly
affected flowering and cotton yield. The greatest
reduction in yield was made more pronounced by
increasing the time of irrigation and soil salinity.
(Jamail-Arizona)
W77-12288

**WATER ARID AGRICULTURES: SALINITY
AND WATERLOGGING IN THE NEAR-EAST
REGION,**
Food and Agriculture Organization of the United
Nations, Cairo (Egypt). Near East Regional Of-
fice.
M. M. Elgabalay.
Ambio, Vol. 6, No. 1, p 36-39, 1977. 1 tab, 7 ref.

Descriptors: *Water utilization, *Salinity,
*Irrigation practices, *Water manage-
ment(Applied), *Crop production, Reclamation,
Conservation, Groundwater, Sprinkler irrigation,
Hydrodynamics, Gypsum, Surface waters,
Groundwater, Water quality, Salt tolerance,
Water policy, Arid lands, Irrigation efficiency,
Agriculture, Arable land, Foreign countries.
Identifiers: *Developing countries, Near-East,
Egypt, Iraq, Pakistan, Trickle irrigation.

Extensive areas of irrigated land in the Near-East
region suffer from salinity and waterlogging,
resulting in low crop yields. These soil problems
can be ascribed to limited water supplies, poor
quality water, inadequate distribution networks,
poor irrigation techniques, and low irrigation ef-
ficiency. Improved water quality management prac-
tices can do more towards immediately remedying
these problems and increasing food supplies than
other agricultural practices. Controlling water
table depth, precision land levelling, suitable
methods of leaching, maintaining a favorable salt
balance, reducing water losses, and practicing ef-
ficient irrigation methods are management practices
of primary importance for an effective water-use
policy. In future, development emphasis should be
placed upon improving storage reservoirs, irriga-
tion techniques, soil reclamation, and monitoring
systems, and upon promoting conservation and
the consolidation of land holdings. (Ullery-
Arizona)
W77-12291

CALIFORNIA'S WATER RECLAMATION AND DESALINIZATION PROJECTS,

California State Dept. of Water Resources, Sacramento.

For primary bibliographic entry see Field 5D.
W77-12295

HOT SPRINGS OF THE CENTRAL SIERRA NEVADA, CALIFORNIA,

Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 2K.
W77-12375

FRESH-WATER RESOURCES IN THE SOUTHEASTERN PART OF THE TULAROSA BASIN,

Geological Survey, Austin, Tex. Water Resources Div.; and Geological Survey, Albuquerque, N. Mex. Water Resources Div.

For primary bibliographic entry see Field 4A.
W77-12392

SALINITY MANAGEMENT WITH DRIP IRRIGATION,

Agricultural Research Service, Riverside, Calif. Salinity Lab.
G. J. Hoffman.

Drip/Trickle Irrigation, Vol. 1, No. 2, p 14-22, August 1976. 9 fig, 1 tab.

Descriptors: *Salinity, Saline soil, Saline water, Irrigation, *Irrigation practices, Irrigation systems.

Identifiers: *Drip irrigation, Trickle irrigation.

The minimum leaching fraction for producing maximum crop yield with high-frequency irrigation is being established. Based on 2.5 years of data, the minimum leaching requirement under high-frequency irrigation is about 5% for wheat and grain sorghum, and between 10 and 15% for lettuce with 2.2-mmno/cm irrigation water. In citrus, after 2 years under drip irrigation, there were no yield or fruit quality difference between 5 and 20% leaching with 1.2-mmno/cm irrigation water, although there are significant differences in the distribution and concentration on soil salinity. Adequate irrigation management in salt-affected soils requires knowledge of and control over the soil matric potential and soil salinity. Soil matric potential can be measured with tensiometers or other soil matric potential sensors, and soil salinity can be detected with salinity sensors or the four-electrode conductivity probe. In salt-affected soils, knowledge of soil salinity in the root zone is required as feedback information to control irrigation from measures of soil matric potential. This knowledge will allow drip/trickle users to optimize the use of their systems for quality and productivity. (Skogerboe-Colorado State)

W77-12530

MANAGING SALINE WATER FOR IRRIGATION,

International Center for Arid and Semi-Arid Land Studies, Lubbock, Tex.

Proceedings of the International Salinity Conference, held at Texas Tech University, Lubbock, Texas, August 16-20, 1976. 618 p. Edited by H. E. Drengne.

Descriptors: *Irrigation, *Irrigation water, Irrigation effects, *Salinity, Saline soils, Saline water, Water quality, *Water quality control, Energy, Saline water systems, *Salt balance, Salts, Model studies, Simulation analysis, *Crop production.

Irrigation water salinity is becoming an increasingly serious problem as water of less and less desirable quality is exploited for irrigation and as greater intensity of water use leads to degradation. Deteriorating quality, combined with rapidly increasing energy costs, has caused a crisis in water

use in pump-irrigated areas. Similarly, river waters have become more highly regulated, water evaporating from reservoirs concentrates the salts, and new irrigation projects aggravate the salinity problem for downstream users. This international conference was held to assess the current state of knowledge about managing saline water for irrigation and to present new information on how to cope with salinity. Plant scientists, soil scientists, and engineers representing 20 countries participated in the sessions. Their findings are presented in this volume. The tone of the papers is one of optimism that moderately saline water can be used successfully for irrigation if what is known already and what is being learned now is used effectively. Mixed with the optimism is the realization that careless management of saline irrigation water can be disastrous to the land and, more importantly, to the people living on that land. (See W77-12727 thru W77-12769) (Skogerboe-Colorado State)

W77-12726

FOLIAR CONTENTS OF SODIUM AND CHLORIDE ON CITRUS ROOTSTOCKS IRRIGATED WITH SALINE WATERS,

Centro de Edagologie y Biologia Aplicada del Segura, Murcia (Spain). Dept. of Fertility and Vegetal Nutrition.

A. Cerda, M. Caro, F. G. Fernandez, and M. G. Guillen.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 155-164. 1 fig, 4 tab, 20 ref.

Descriptors: Saline water, *Salinity, Irrigation, Irrigation effects, *Sodium chloride, *Citrus crops.

Identifiers: Seedlings, Rootstocks.

A greenhouse experiment was conducted with six citrus seedlings used as rootstocks in containers filled with a calcareous soil. These seedlings were irrigated with water salinized differentially with NaCl. As the experiment progressed, the salinity levels of the water were increased except for the controls. The experiment was carried out over a period of 13 months under differential irrigation treatment. Leaf samples were collected 4 times during the experiment. Chemical analysis of the leaf samples revealed marked differences in Na and Cl content due to seedling variety, salinity level of irrigation water, and length of treatment period. Leaf samples from Sour Orange seedlings contained the highest concentration of Cl. Leaf samples from the Cleopatra Mandarin seedlings contained the least amount of Cl. Leaf samples from the Kinnow seedlings contained the highest amount of Na and those from the Sour Orange seedlings the least. (See also W77-12726) (Skogerboe-Colorado State)

W77-12727

GROUNDWATER OF VOJVODINA, ITS QUALITY AND APPLICABILITY FOR IRRIGATION,

Novi Sad Univ. (Yugoslavia). Faculty of Agriculture.

For primary bibliographic entry see Field 5B.
W77-12728

CALCULATION AND PREDICTION OF THE SALT REGIME OF LOWLAND SOILS UNDER INFLUENCE OF GROUNDWATER SALINIZATION,

Institut za Vodoprivredu Jaroslav Cerni, Belgrad (Yugoslavia).

For primary bibliographic entry see Field 2G.
W77-12729

RESISTANCE TO SODA SALINIZATION OF SOME IRAQI SOILS,

Baghdad Univ. (Iraq). Coll. of Agriculture.

For primary bibliographic entry see Field 2G.
W77-12730

MODELS FOR PREDICTING THE IMPACT OF IRRIGATION ON SOIL SALINITY,

Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics; and Hebrew Univ., Jerusalem (Israel).

For primary bibliographic entry see Field 2G.
W77-12731

CONVECTIVE TRANSPORT OF SOLUTES IN AND BELOW THE ROOT ZONE,

Agricultural Research Service, Riverside, Calif. Salinity Lab.

For primary bibliographic entry see Field 5B.
W77-12732

USE OF HIGHLY-SALINE WATER IN CITRUS IRRIGATION,

Agricultural Research Organization, Bet-Dagan (Israel). Div. of Citriculture.

A. Goell, M. E. Rais, and A. El-Wahidi.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 236-245. 2 fig, 3 tab, 7 ref.

Descriptors: *Saline water, *Salinity, Orchards, Irrigation, *Irrigation effects, *Chlorine, Crop response, Oranges, Soil moisture, Nutrients, *Citrus crops.

Identifiers: *Israel.

High Cl salinities in the water used to irrigate Citrus orchards in the Gaza Region on the southern coastal plain of Israel have caused yields to peak earlier, and to decline more rapidly than in orchards of the same age irrigated with water containing minimal amounts of Cl. Vegetative growth on such trees becomes less vigorous, leaves develop chlorosis, age quickly and drop earlier. Overall yields are lower and long-term profitability of the orchard is further reduced by the high incidence of 'creased' fruit. Various cultural treatments have been tried in an irrigation-frequency experiment in a Valencia orange orchard with the aim of stimulating new and more vigorous growth in the trees. A treatment combining a period of moisture stress in early summer (stoppage of irrigation) and the supply of a highly-available nitrogenous fertilizer when irrigation was resumed in mid-summer proved effective in stimulating much vigorous late summer vegetative growth. The effects of this treatment and its long-term effects on growth and cropping are discussed. (See also W77-12726) (Skogerboe-Colorado State)

W77-12733

SALT TOLERANCE OF BEANS UNDER A SAND MULCH CULTURE,

Escuela Tecnica Superior de Ingenieros Agronomos, Madrid (Spain). Catedra de Edafologia.

M. A. Parra, and G. C. Romero.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 220-235. 5 fig, 6 tab, 20 ref.

Descriptors: *Salt tolerance, Crop production, *Beans, Saline soil, *Salinity, Crop response, *Sands.

Salt tolerance of two cultivars of beans grown for green consumption under a sand mulch culture has been studied. The influence of the growing season and the time of soil salinization on salt tolerance as well as the tolerance during germination have also been investigated. Under early salinization regimes and high evapotranspiration demands, yields were reduced by 50% of the maximum at EC_{se} of 6 mmhos/cm. This latter figure means an almost twofold higher salt tolerance was increased by almost 100% when the crop was grown under low evapotranspiration demands (fall culture). An additional 30% salt tolerance increase was observed when soil salinization was delayed twenty days. Increasing yields of first picking and dry pod matter observed with increasing soil salinity sug-

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C—Use Of Water Of Impaired Quality

gest that soil salinity accelerates fruit ripening. (See also W77-12726) (Skogerboe-Colorado State) W77-12734

PROBLEMS OF MANAGING GEOTHERMAL WATERS FOR IRRIGATION, Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering. H. B. Peterson, and J. L. Shupe. In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 211-219. 5 fig, 2 tab, 8 ref.

Descriptors: Irrigation, *Irrigation water, *Geothermal studies, *Groundwater, *Chemicals. Identifiers: *Geothermal energy.

With the development of geothermal water as a source of energy, there will be considerable 'spent water' available for other purposes. In the United States most of the known geothermal basins are in the Western States where water is scarce and the need and temptation to use spent geothermal water for irrigation is great. This will also likely be true in other parts of the world. This discussion is concerned with minimizing or avoiding adverse effects caused by chemical constituents and not the possible benefits or damage to crops from the heat in the water. (See also W77-12726) (Skogerboe-Colorado State) W77-12735

SOIL SALINITY AND PLANT NUTRITIONAL STATUS, Kiel Univ. (West Germany). Institut fuer Pflanzenernaehrung und Bodenkunde. A. Finck. In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 199-210. 9 fig, 1 tab, 19 ref.

Descriptors: *Saline soils, Crop production, *Nutrients, Nitrogen, Calcium, Fertilization, *Salinity.

Plants of saline soils not only suffer from water deficiency, but also from nutritional disturbances. Especially at low and medium degrees of salinity the surplus of some elements (nonnutrients or nutrients) or the real or induced deficiency of nutrients creates a nutritional stress that is often responsible for yield depressions. The extreme nutrient situation can partly be corrected by fertilization improving the ratio between necessary and unwanted ions in the plants as well as by improvement of other minimum factors such as trace element supply. The base of fertilization, however, should be a reliable plant diagnosis considering that the usual limiting values for optimum supply or tolerance will have to be partly modified under saline conditions. (See also W77-12726) (Skogerboe-Colorado State) W77-12736

CROP SALT TOLERANCE: EVALUATION OF EXISTING DATA, Agricultural Research Service, Riverside, Calif. Salinity Lab. E. V. Maas, and G. J. Hoffman.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 187-198. 8 fig, 1 tab, 23 ref.

Descriptors: Crop production, Salinity, Salts, *Salt tolerance, Evaluation, Data collections.

An extensive review and evaluation of the past 30 years' literature on crop salt tolerance was undertaken to assess the relative tolerance of as many agricultural crops as possible. Most crop yields decrease linearly as salt concentrations are increased above a tolerance threshold. Our best estimates of the threshold salinity and the yield decrease as a function of salinity are presented graphically for over 60 agricultural crops. The

criteria required to express salt tolerance, and the factors that influence and limit the applicability of these data are discussed. (See also W77-12726) (Skogerboe-Colorado State) W77-12737

PREDICTED AND ACTUAL YIELD DECLINE FROM FIFTY PERCENT INCREASE IN SALINITY OF THE COLORADO RIVER, California Univ., Davis. Div. of Agricultural Sciences. F. E. Robinson.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 170-174. 1 tab, 1 ref.

Descriptors: *Crop production, Sprinkler irrigation, Irrigation, Soil moisture, *Salinity, Saline water, Carrots, Onions, Beans, *Colorado River, Forecasting.

Six crops were grown in a sprinkler irrigated field with water applications based upon 10 cm available moisture and an application to pan evaporation ratio of 0.90. Utilizing data from the California Committee of Consultants, increase in water salinity from ECm=1.35 mmho/cm to 2 mmho/cm predicted yield decreases of greater than 10% for carrots, onions, and beans. These three crops exhibited significant field yield reductions of the same order of magnitude as that predicted. In the wheat, cabbage, and alfalfa yield predictions, the decline was less than 10% and the field yield reductions were not significant. Normal field trial yield variation tends to obscure the first 10% yield reduction due to salinity. (See also W77-12726) (Skogerboe-Colorado State) W77-12738

TRANSPLANTATION OF JUNCUS SPP. ON SALINE SOILS IN EGYPT, Mansoura Univ. (Egypt). Dept. of Botany. M. A. Zahran, I. H. El-Bagoury, A. A. Abdel Wahid, and M. A. El-Demerdash.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 142-154. 2 fig, 3 tab, 11 ref.

Descriptors: *Salinity, *Saline soils, Crop production, Phosphorous, Nitrogen, Fertilization. Identifiers: *Egypt, *Juncus spp.

The saline lands of Egypt occupy vast areas along the Mediterranean Sea and the Red Sea coasts and in the inland deserts. Cultivation of these areas with halophytic plants that proved to be of economic importance may extend the cultivable lands of Egypt and supply the country with raw materials for industrial purposes. *Juncus rigidus* and *J. acutus* are salt tolerant and fiber plants. Their culms can be used as raw material in paper industry and their seeds may be used as a source of drugs and oils. Transplantation experiments on saline soil associated with Manzala Lake of Egypt were carried out. The results were encouraging. Both species succeeded to grow but the vegetative yield of *Juncus rigidus* was, relatively, higher than that of *J. acutus*. Nitrogen-phosphorous fertilization treatments showed marked effect on the vegetative yields. The fresh and dry weights, as well as the lengths, of the culms increased progressively with the increased amount of nitrogen in soil but phosphorous fertilizer showed reverse effect. Excess phosphorous in soil hinder the uptake of nitrogen by *Juncus* plants. (See also W77-12726) (Skogerboe-Colorado State) W77-12739

COMPOSITION OF SALINE DRAINAGE WATER IN IRAQ AND ITS USE, State Organization of Soils and Land Reclamation, Baghdad, (Iraq). A. B. Hanna.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 590-597, 4 tab, 4 ref.

Descriptors: Drainage, *Drainage water, Salinity, *Salts, Dissolved solids, Calcium, Magnesium, *Saline water, Water quality, Leaching, *Saline soils. Identifiers: *Iraq.

Three years of study of the composition of drainage water indicated that the seasonal fluctuation of total salt concentration is more pronounced than the kind of salts, depending on agricultural activities and the status of water regime of the rivers. Total soluble salts in the drainage water varies from 7-32 mmhos/cm while the SAR ratio is about 5 in low saline samples and approaches 30 in other high saline water. An example is given, here, to make use of some of these saline waters in the first stages of leaching a highly saline alkali soil. This study indicated that about 20% of good quality water required for leaching was saved by using a 10 mmhos/cm drainage water having an SAR ratio of about 10 to an adjacent soil having in the top layer a conductivity of 124 mmhos/cm and an SAR of 20. (See also W77-12726) (Skogerboe-Colorado State) W77-12740

SYSTEM FOR MANAGING SALINE AND RUN-OFF WATER FOR FRUIT AND CROP PRODUCTION IN ARID REGIONS OF MEXICO, Food and Agriculture Organization of the United Nations, Rome (Italy).

S. A. Gavande, C. B. Cluff, and N. Nahlawi. In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 575-589, 6 fig, 3 tab, 3 ref.

Descriptors: *Mexico, Saline soils, *Return flow, Runoff, Tailwater, *Irrigation water, *Saline water, Orchards, Economics, *Crop production, Water quality, Fruit crops, Arid lands.

Nearly 30% of the total area in Northern Mexico is extremely arid and presents some saline and alkali problems. Irrigation water from wells when available is often saline. A feasibility study by FAO for orchard development in this area showed that by using runoff water from compacted inter-row area and storing and recirculating this water, economic returns would be satisfactory. Total system of working model consisted of low cost water harvesting subsystems, simple water harvesting agri-subsystem and efficient compartmented tank system. A 20 hectare system consisting of 10 hectares of fruit and 10 hectares of dry farming were found to give internal return of 25% and benefit cost ratio of 3:1. (See also W77-12726) (Skogerboe-Colorado State) W77-12741

YIELDS AND ACREAGE AS VARIABLES IN PLANNING THE USE OF SALINE IRRIGATION WATER: A CASE STUDY FROM IRAN, Technische Universitaet, Brunswick (West Germany). Leichtweiss Inst. for Water Research. H. Diestel, and W. Treitz.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 480-493, 3 tab, 26 ref.

Descriptors: Salinity, *Irrigation water, Water quality, *Saline water, Salts, River systems, Economics, *Crop production, Leaching, Planning. Identifiers: *Iran (Hableh Rud River).

Economic aspects of the salinity of irrigation water are discussed. A case preliminary economic planning with irrigation water quality is described. Tributaries of the Hableh Rud River contributed about 4% to the water discharge, but about 50% to the salt discharge of the river. Two schemes to divert tributary flow are evaluated from the economical (national) and financial (private) points of view. Two alternatives of use would exist with the improved river water; to apply it to the area which is irrigated without project implemen-

tation, which, in the long run, would result in yield increases, or to make use of the reduction in leaching requirement by increasing the irrigated area. It is shown that the latter alternative can be expected to be more profitable. Values are given in Rials per unit of salinity of river water which the farmers of Garmsar and the national economy could pay per year for water improvement. It is estimated that, in this case, it would be only 25% more expensive to gain land by salinity reduction than by additional supply of equal quality irrigation water. (See also W77-12726) (Skogerboe-Colorado State)
W77-12742

CHEMICAL RECLAMATION OF SOLONETZ-SOLOCHAKS IN THE ARARAT PLAIN AND THE POSSIBILITY OF UTILIZING SALINE WATERS FOR LEACHING AND IRRIGATION, Armenian Agricultural Inst., Erevan. Inst. of Soil Science and Agrochemistry.
G. P. Petrosian.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 466-479, 7 fig, 2 tab.

Descriptors: Sodium, *Saline soils, Salinity, Sulphuric acids, Crop production, *Leaching, Irrigation, *Irrigation water, Irrigation practices, *Saline water, *Soil amendments.

Waste sulphuric acid and iron vitriol are the most efficient amendments for improving soda saline soils. Their ameliorative influence may be revealed in a very short time. Applying sulphuric acid and iron vitriol causes neutralization of alkaline reaction and desalinization of the soil, sharply increasing infiltration rate and permeability in it. On the reclaimed soils high-yielding annual and perennial crops are cultivated, securing very quick returns of capital investments. (See also W77-12726) (Skogerboe-Colorado State)
W77-12743

POTENTIAL FOR SALINE WATER IRRIGATION OF TROPICAL SOILS, Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.

S. A. El-Swaify, S. Sinanuwong, A. R. Daud, and A. Tengah.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 358-375, 4 fig, 4 tab, 16 ref.

Descriptors: *Saline water, Salts, Soil chemical properties, *Soil physical properties, Irrigation, *Irrigation practices, Hydraulic conductivity, *Soil chemical properties, Ions, Cation exchange.
Identifiers: *Tropical soils.

The effects of waters with defined salt concentration and ionic composition on the chemical and physical properties of irrigable tropical soils belonging to four Orders were investigated. Studies of cation exchange equilibria indicated that soil affinities for sodium ion adsorption were generally in the order of Oxisols less than Aridisols less than Mollisols less than Vertisols. As a group, however, these soils exhibited less tendency to accumulate detrimental sodium ions on the exchange complex than is known for temperate arid region soils. Evaluation of soil physical responses to changes in water quality by direct stability and hydraulic conductivity methods showed that soil susceptibilities to structural breakdown depended on the presence or absence of swelling minerals. Both were in the order of Aridisols less than or equal to Oxisols less than Mollisols less than Vertisols. It was concluded that a promising potential exists for using saline waters for irrigation of certain soils in the tropics when use of such waters is necessary for expanding available water resources. (See also W77-12726) (Skogerboe-Colorado State)
W77-12744

IRRIGATION WITH SALINE WATER IN SOUTH TEXAS,

Texas A and M Univ., Weslaco. Agricultural Research and Extension Center.
B. W. Hipp.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 345-349, 4 fig, 6 ref.

Descriptors: *Texas, *Irrigation water, *Saline water, Water quality, Salts, Leaching, Cotton, *Saline soils.

South Texas and northeastern Mexico is highly dependent upon irrigation water with an EC that ranges from 1 to 4.4 mmhos/cm. Studies were conducted on sandy loam soil to determine the influence of irrigation water quality on salt distribution in the soil profile and to determine the importance of summer and fall rains in leaching salts from irrigated land. Cotton was irrigated with water with EC values of 1.2, 2.6, and 4.2 mmhos/cm. Soil salinity was monitored with salinity sensors after 0, 20.3 and 30.5 cm of irrigation water was applied and after 32.7 cm of rainfall. Before irrigation, EC of the 15 to 120 cm soil profile to about 2.5 mmhos/cm but two irrigations (10 cm each) increased soil salinity in the 15 to 60 profile to about 2.3 and 4.5 mmhos/cm for the 1.2, 2.6 and 4.2 mmhos/cm irrigation water, respectively. Three irrigations with 4.2 mmhos/cm water resulted in soil EC of 7.2, 6 and 5 mmhos/cm at 15, 30, and 60 cm depths, respectively. Soil salinity in the root zone was decreased after 32.7 cm of rainfall in July and August. This salt application and subsequent leaching pattern is typical of the irrigated area of South Texas and northeastern Mexico and it allows growers to use relatively saline water for irrigation. (See also W77-12726) (Skogerboe-Colorado State)
W77-12745

IRRIGATION WITH SALINE WATER IN THE PECOS VALLEY OF WEST TEXAS,

Texas A and M Univ., Pecos. Agricultural Research Station.

J. Moore, and J. J. Hefner.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 339-344, 1 tab, 7 ref.

Descriptors: *Texas, *Saline water, Irrigation water, Dissolved solids, Crop production, Drainage, Irrigation effects, Irrigation efficiency, Saline soil, Salinity.
Identifiers: *Pecos Valley(Tex).

The Pecos Valley of West Texas has been under cultivation for 30 years with pump irrigated saline water averaging 2500 ppm total salts. This quantity of salts has restricted selection of crops to more salt tolerant plant species and required excessive water for leaching. Primary problems are associated with establishment of crops. Once beyond the seedling stage, growth and yield have generally been acceptable. Internal drainage remained good and severe salt buildup has not occurred because of favorable types of clay minerals and ionic composition of irrigation waters. The major problem facing the area is high production cost, especially that of pumping irrigation water. Expiration of a long term natural gas contract in 1975 led to a 500 percent increase in 1976. This has curtailed farming operations and has placed added emphasis on more efficient use of water. New concepts and modifications of present irrigation management systems are being introduced. The saline nature of the water and soils require that any changes in the overall management systems be carefully investigated to assess its future consequences on agriculture in the area. (See also W77-12726) (Skogerboe-Colorado State)
W77-12746

SALINITY EFFECTS ON CORN YIELD, EVAPOTRANSPIRATION, LEACHING FRACTION, AND IRRIGATION EFFICIENCY, California Univ., Davis. Water Science and Engineering Section.

J. I. Stewart, R. M. Hagan, and W. O. Pruitt.

Descriptors: *Salinity, *Crop production, *Evapotranspiration, *Leaching, *Irrigation efficiency, Irrigation water, Saline water, Salt balance, *Corn(Field).

In each individual cropping situation there exists a 'limiting salt concentration' (LSC) at which irrigation water can no longer be absorbed by roots of plants and transpired. The LSC in any particular farm field and season depends on crop type, soil texture, and salinity of the upper profile soil solution in which germination and early root activity takes place. Irrigation water can only be concentrated to the LSC which is determined by the early conditioning of the crop, and which in future may be estimated by a preplant measurement of the upper soil salinity. Thus, a 'refusal fraction' (RF) also exists which is dependent on the LSC, and on the salinity of the irrigation water supply. The RF is the portion of applied water which remains in the soil and which contains the concentrated salts at the LSC level, when transpiration has effectively ceased. The RF pertains whether water supply is adequate for the crop or is limited, and whether or not leaching occurs. If there is leaching during the growing season in question, the RF constitutes the minimum leaching fraction which will maintain the salt balance of the root zone. (See also W77-12726) (Skogerboe-Colorado State)
W77-12747

IRRIGATION WITH SALINE WATER UNDER DESERT CONDITIONS,

Higher Agricultural Council, Baghdad (Iraq).

A. Hardan.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 165-169, 2 tab, 6 ref.

Descriptors: *Crop production, *Groundwater, Rainfall, Salinity, *Saline water, Orchards, Crop response, Salts, *Irrigation water, *Deserts, Arid lands, *Water harvesting.

A Desert Development Program was designed and initiated to determine the potentiality of agricultural production under desert conditions through the development of available groundwater and harvested rainfall. The suitability of different management practices of water, soil, and crops are under study in several stations in the Western Desert of Iraq. The central station is located about 60 km west of the town of Haditha at an elevation of 320 m above sea level. The average rainfall of this station is 11 cm. Irrigation waters of about 500, 2000, and 4000 ppm soluble salt concentration were used to irrigate pear trees, wheat, and potatoes. Data on soil salinity, tree growth, and yield of wheat and potatoes were collected and analyzed. The results show no significant difference in the growth of pear trees or in wheat production at all levels of water salinity. However, the production of potatoes decreased significantly at the 4000 ppm level of soluble salt concentration. (See also W77-12726) (Skogerboe-Colorado State)
W77-12748

WATER QUALITY AND RETURN FLOW STUDY OF THE OAHU UNIT, SOUTH DAKOTA,

Bureau of Reclamation, Denver, Colo. Colorado River Water Quality Office.

For primary bibliographic entry see Field 5G.
W77-12750

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C—Use Of Water Of Impaired Quality

EFFECTS OF IRRIGATION LEACHING MANAGEMENT ON RIVER AND SOIL WATER SALINITY

Agricultural Research Service, Riverside, Calif. Salinity Lab.
D. L. Saurez, and J. D. Rhoades.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 95-108. 5 tab, 8 ref.

Descriptors: Irrigation, Irrigation systems, *Irrigation efficiency, *Soil water, *Groundwater, River systems, *River basins, *Leaching, *Salinity, Saline water, *Irrigation effects.

Information about the effects of irrigation management on the changes in river water, soil water, and groundwater quality associated with successive downstream water diversion for representative types of river waters is provided. The deposition of CaCO_3 and gypsum in entire river basins as a function of leaching fraction is also considered. (See also W77-12726) (Skogerboe-Colorado State)
W77-12751

VARIOUS INDICES FOR EVALUATING THE EFFECTIVE SALINITY AND SODICITY OF IRRIGATION WATERS

Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Oster, and J. D. Rhoades.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 1-14. 5 fig, 2 tab, 20 ref.

Descriptors: *Irrigation water, *Salinity, *Saline water, Simulation analysis, Model studies, Evaluation, *Alkalinity.

The salinity and sodicity hazards of irrigation water were evaluated by several methods including residual sodium carbonate, pHc^* and a computer simulation of gypsum and aragonite precipitation based on an assumed water uptake and PCO_2 distribution through the root zone. No useful correlation was found between the computer predicted relative calcium and bicarbonate precipitation and residual sodium carbonate. A correlation of r as similar or equal to .7 was found for pHc^* . Relative calcium precipitation was correlated, r as similar or equal to .8, with $(\text{CCA}/\text{CSO}_4)$, where C is concentration (meq/l) in the irrigation water, when the product exceeded 30. The SAR's calculated from pHc^* and the simulation model, for the soil surface and bottom of the root zone, were also correlated, r is equal to .99. (See also W77-12726) (Skogerboe-Colorado State)
W77-12752

WATER QUALITY FOR AGRICULTURE

California Univ., Davis. Dept. of Land, Air, and Water Resources.

For primary bibliographic entry see Field 5G.
W77-12753

MINIMIZING THE SALT BURDEN OF PECOS RIVER IRRIGATION DRAINAGE WATER

New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5G.
W77-12754

FATE OF SALTS FROM WATER AND MANURE IN A 4-YEAR FIELD EXPERIMENT

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W77-12755

DISTRIBUTION AND SEASONAL VARIABILITY OF MICRONUTRIENTS IN CERTAIN SALT AFFECTED SOILS OF NORTHERN GREECE

Democritus Nuclear Research Center, Athens (Greece).
For primary bibliographic entry see Field 5B.
W77-12756

DETAILED RETURN FLOW SALINITY AND NUTRIENT SIMULATION MODEL

Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 5G.
W77-12757

A CONCEPTUAL HYDROSALINITY MODEL FOR PREDICTING SALT LOAD IN IRRIGATION RETURN FLOWS

California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 5B.
W77-12758

HYDROSALINITY MODELING OF IRRIGATION RETURN FLOW IN THE MESILLA VALLEY, NEW MEXICO

New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 5B.
W77-12759

IRRIGATION MANAGEMENT WHERE SALINITY SOURCES AND SINKS ARE PRESENT

Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
R. J. Hanks, L. S. Willardson, J. J. Jurinak, and J. D. Melamed.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 15-27. 6 fig, 1 tab, 14 ref.

Descriptors: *Salinity, Salts, *Saline soils, *Irrigation water, Irrigation, Irrigation effects.
Identifiers: Salinity sources, Salinity sinks.

Where sources and sinks are presented irrigation must be modified considerably. Sources and sinks are found where salts have precipitated out of the soil solution (Sink) or dissolved into the soil solution from solid phase salts (Source). An empirical addition to a previous model was devised to account for these source-sinks which were found to be very important in the field at Ashley Valley, Utah. The model predicts that where sources are present, irrigation management variations has little influence on profile soil salinity for many years. Similarly it predicted that salt concentration into the drainage water will not change for many years regardless of the irrigation management used. Where a water table is present irrigation less than enough to meet evapotranspiration demands will be possible for many years with no adverse effect. These predictions agree with field measurements. (See also W77-12726) (Skogerboe-Colorado State)
W77-12760

INTEGRATING DESALINATION AND AGRICULTURAL SALINITY CONTROL TECHNOLOGIES

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3A.
W77-12761

DESALINIZATION OF A HIGHLY SALINE SOIL, PREDICTION AND FIELD OBSERVATION

Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use.
For primary bibliographic entry see Field 3A.
W77-12762

ON-FARM WATER MANAGEMENT PRACTICES FOR ALLEVIATING WATERLOGGING AND SALINITY PROBLEMS IN PAKISTAN

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W77-12763

EVALUATING IMPROVED IRRIGATION WATER MANAGEMENT TECHNOLOGIES FOR REDUCING SALT PICKUP FROM GRAND VALLEY

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W77-12764

MAP OF SALTY SOILS OF AFRICA

Office de la Recherche Scientifique et Technique Outre-Mer Bondy (France).
For primary bibliographic entry see Field 2G.
W77-12765

BASIC PRINCIPLES FOR PROGNOSIS AND MONITORING OF SALINITY AND SODICITY

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 2G.
W77-12766

SALINITY SURVEY IN ISRAEL

Ministry of Agriculture, Tel-Aviv (Israel). Irrigation and Soil Field Service.
For primary bibliographic entry see Field 2K.
W77-12767

SALINE WATER CLASSIFICATION IN IRAN BY RATIONAL METHODS

Tehran Univ., Karaj (Iran). Dept. of Soil Science. A. M. Massoumi.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 455-465, 4 fig, 3 tab, 4 ref.

Descriptors: *Saline water, *Salinity, *Irrigation efficiency, Irrigation, *Irrigation water, *Classification.
Identifiers: *Iran.

The classification of saline water is very important for irrigation projects in Iran. The application of U.S.S.L. method has not given a good result in this country. Therefore, it was decided to examine, the rational method which is based on plant resistance against the salinity, the texture of soils, and irrigation efficiency. For a given plant, growth in a given soil, the quality of irrigation water depends only on the efficiency of irrigation. (See also W77-12726) (Skogerboe-Colorado State)
W77-12768

FIELD TESTING OF A NEW SYSTEM FOR QUALIFYING IRRIGATION WATER

Instituto de Edafologia, Maracay (Venezuela). I. P. Sentis, and F. Dappo.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 376-387. 1 fig, 5 tab, 14 ref.

Descriptors: *Irrigation water, *Salinity, Salts, Saline soils, Salt balance, Leaching, Calcium, Magnesium, Drainage, Crop production, *Sodium, Testing.
Identifiers: *Venezuela.

A new system for evaluating irrigation waters in relation to the potential problems of salinity and sodicity is tested under five different situations of salt affected soils in Venezuela. The system is based on an independent balance of the different ions in soil solution in relation to the effective

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leaching and limiting solubilities of Ca sulfates and Ca plus Mg carbonates. Qualification is based not only on the concentration and composition of salts in irrigation water but on the drainage conditions of the soil profile and on the crop tolerance. (See also W77-12726) (Skogerboe-Colorado State) W77-12769

U.S.S.R.: GOLODNAYA (HUNGRY) STEPPE, (CASE STUDY OF DESERTIFICATION). Ministry of Reclamation and Water Management, Moscow (USSR). United Nations Conference on Desertification, International Co-operation in the Control of Desertification, Nairobi, August 29-September 9, 1977. A/Conf. 74/23. 76 p.

Descriptors: *Land reclamation, *Irrigation effects, *Arid lands, *Irrigation programs, *Land development, Salinity, Irrigated land, Evaporation, Transpiration, Environmental effects, Groundwater, Saline soils, Soil moisture, Zone of aeration, Crop production, Cotton, Salt balance, Costs, Drainage. Identifiers: *USSR(Golodnaya Steppe).

Data are presented on the development of desert lands in the Golodnaya Steppe, a region with poor natural drainage conditions and saline soils. Irrigation supply under inadequate drainage conditions disrupts the established groundwater balance. Evaporation of saline water develops a positive salt balance in the zone of aeration. The environmental impacts of arid lands irrigation are fully discussed, including 'climate softening,' changes in flora, and the relation of processes occurring to water, soil, subsoil, and salts within the irrigation area and the irrigation source connected with it. Land development in the southern steppe lowland is described in detail; expenditure and profit information is included. A method for integrating irrigation construction and large-scale development of new irrigated arid zone lands has been evolved based on experience in the Golodnaya Steppe and is discussed in detail. (Mills-Arizona) W77-12825

INFLUENCE OF SEED PRETREATMENTS ON SALT TOLERANCE OF COTTON DURING GERMINATION. Agricultural Research Service, Riverside Calif. Salinity Lab. M. C. Shannon, and L. E. Francois. Agronomy Journal, Vol 69, No. 4, p 619-622, July-August, 1977, 3 fig, 1 tab, 20 ref.

Descriptors: *Seed treatment, *Salt tolerance, *Germination, *Cotton, *Saline soils, Salinity, Arid lands, Salts, Sodium chloride, Saline water, Seeds, Irrigated land, Crop production, Irrigation water, Irrigation, Stress, Soil-Water-Plant relationships, Semiarid climates. Identifiers: Hormone pretreatments.

A study was conducted to determine if various seed pretreatments could increase the salt tolerance of a commercial variety of long-staple cotton (*Gossypium barbadense* L.). Salts, phytohormones, and adenosine monophosphate were used in twelve pretreatments (including a dry control and a distilled water control), and their effectiveness tested by germinating the seeds in single and mixed salts of NaCl and CaCl₂, as well as distilled water. No evidence was found that pretreatment increases salt tolerance during germination. The beneficial effects seem limited to water pretreatment which hastened the germination of seed by one day over dry controls. A single four-hour soaking was optimal. This is hardly noteworthy under optimum field conditions, but under stress conditions it may be significant. (Ullery-Arizona) W77-12831

WATER IN KUWAIT, Durham Univ. (England). Dept. of Geography.

For primary bibliographic entry see Field 3A. W77-12837

EFFECTS OF SALINITY, TEMPERATURE AND NITROGEN FERTILIZATION ON GROWTH AND COMPOSITION OF RHODES GRASS (CHLORIS GAYANA KUNTH), Tel Aviv Univ. (Israel). Dept. of Botany. J. Guggenheim, and Y. Waisel. Plant and Soil, Vol. 47, p 431-440, June, 1977, 12 fig, 3 tab, 14 ref.

Descriptors: *Salinity, *Irrigation effects, *Saline water, *Plant growth, *Nitrogen fixation, *Forage grasses, Nitrogen, Fertilizers, *Fertilization, Crop response, Grasses, Forages, Alkalinity, Semiarid climates, Nitrates, Temperature, Irrigation water. Identifiers: *Rhodes Grasses, Israel.

Rhodes grass is one of the most widely grown forage grasses in warm countries and comprises one of the major sources of forage in Israel. A study was conducted in Israel to determine the effects of saline irrigation waters and nitrogen fixation on growth of Rhodes grass, and on accumulation of free nitrates. Experiments were conducted in sand cultures and the results presented. High temperature, salinity and nitrogen fertilization have a similar effect on Rhodes grass, decreasing the tillering capacity of the plants. Implications of the results are that nitrogen fertilization should be kept low and carefully balanced during the hot summer months when saline irrigation water is used. However, saline water reduces the content of free N-NO₃, thus raising the quality of the crop produced under such conditions. (Jamail-Arizona) W77-12842

3D. Conservation In Domestic and Municipal Use

A COMMUNITY DEVELOPER'S ROLE IN ENVIRONMENTAL PLANNING AND MONITORING, Soil Conservation Service, Lincoln, Nebr. Midwest Technical Service Center. For primary bibliographic entry see Field 5C. W77-12396

URBAN RUNOFF CHARACTERISTICS: VOLUME I - ANALYTICAL STUDIES, Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5B. W77-12477

IMPACTS OF WATER AVAILABILITY ON RESIDENTIAL DEVELOPMENT, Westfield State Coll., Mass. For primary bibliographic entry see Field 6D. W77-12891

3E. Conservation In Industry

MAGNETIC SEPARATION OF SOLUBLE ORGANIC POLLUTANTS FROM WATER, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5D. W77-12255

RESOURCE INFORMATION APPLIED TO WATER SOURCES AND DISCHARGES AT EXISTING AND POTENTIAL POWER PLANT SITES IN ARIZONA AND THE SOUTHWEST, Arizona Water Resources Research Center, Tucson. K. J. DeCook, and R. A. Fazzolare. Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 623,

Price codes: A02 in paper copy, A01 in microfiche. Completion Report, 1977. 10 p, 1 fig, 1 tab, 4 ref. OWRT A-043-ARIZ(3), 14-31-0001-4003.

Descriptors: *Cooling water, Information retrieval, Nuclear powerplants, *Water reuse, *Southwest U.S., *Arizona, Energy, Water demand, *Industrial production, *Water supply, Groundwater. Identifiers: Municipal wastewater.

A growing demand for energy production in Arizona has increased the need for assembling and analyzing water resource information relative to energy production, especially electrical power generation. Unit water requirements for cooling of electrical plants, combined with projections of future electrical power demands in Arizona, provide a perspective on future quantities of water needed for cooling. Probabilistic estimates of storage reserves in Arizona groundwater basins indicate that some prospective plant sites can be supplied from groundwater for the 30-year life of the plant, while others cannot. An estimate of comparative cost for supplying groundwater versus municipal wastewater for cooling electrical plants at selected sites in Arizona showed that use of wastewater would result in considerable savings over use of groundwater at all sites considered. W77-12263

APPLICATION OF REVERSE OSMOSIS IN THE PULP AND PAPER INDUSTRY, Institute of Paper Chemistry, Appleton, Wis. For primary bibliographic entry see Field 5D. W77-12342

WATER USAGE IN PAPER AND BOARD MILLS, Jaakko Poyry Consulting Ltd., Sidcup (England). S. Norton. Paper, Vol. 186, No. 11, p 727, 729-730, 732, December 6, 1976. 1 fig, 10 ref.

Descriptors: *Pulp and paper industry, *Water conservation, *Water pollution control, Europe, Water utilization, *Water reuse, Waste water(Pollution), North America, Water consumption, Water supply. Identifiers: United Kingdom, Closed systems, Board mills, Paper mills, Paper machines, Board machines.

Effluent from nonintegrated paper and board mills can be reduced by reusing water removed at the paper machine wet end and press section. Problems caused by closing up the water system of a paper machine are discussed briefly, and data are presented showing specific water consumption (cu m/ton) for nonintegrated paper and board mills in Europe and North America. Examples are given of closing up the water system on a multi-ply board machine and water conservation on a fine-paper machine. Water supply sources are also discussed. (Will-IPC) W77-12344

MATERIALS BALANCE AND POLLUTION LOAD - EXAMPLE FROM THE PULP AND PAPER INDUSTRY (BILAN MATIERES ET FLUX DE POLLUTION - EXEMPLE DE L'INDUSTRIE DE LA PATE A PAPIER), Groupement Europeen de la Cellulose, Paris (France). For primary bibliographic entry see Field 5B. W77-12345

PROCESSING CHANGES AND CLOSED SYSTEMS DESIGNED FOR MINIMUM EFFLUENT DISCHARGE FROM THE MANUFACTURE OF PAPER PULP (PROCESSANDRINGAR OCH SLUTNA SYSTEM FOR ATT MINSKA UTSLAPP FRAN TILLVERKNING AV PAPPERSSMASSA), IVI Konsult A.B., Stockholm (Sweden).

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3E—Conservation In Industry

For primary bibliographic entry see Field 5D.
W77-12361

NORTHERN GREAT PLAINS RESOURCES PROGRAM: WATER QUALITY SUBGROUP REPORT,

Northern Great Plains Resources Program, Denver, Colo.

For primary bibliographic entry see Field 5C.
W77-12588

ENERGY (HOT WATER) STORAGE IN GROUNDWATER AQUIFERS,

Texas A and M Univ., College Station. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 4B.

W77-12625

THE IMPACT OF ENERGY DEVELOPMENT ON WATER RESOURCES IN THE UPPER COLORADO RIVER BASIN,

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.

M. Flug, W. R. Walker, G. V. Skogerboe, and S. W. Smith.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 017. Price codes: A08 in paper copy, A01 in microfiche. Completion Report, August 1977. 158 p, 31 fig, 30 tab, 42 ref. OWRT C-6076(5211)(2).

Descriptors: *Coals, *Hydroelectric power, *Mathematical models, *Mining, *Nuclear energy, *Oil shales, *Optimization, *Salinity, *Colorado River Basin, Energy, Industrial water, Industrial production, Water demand.

Identifiers: Resource conversion, Water resource availability, Energy development, Upper Colorado River Basin.

The Upper Colorado River Basin contains appreciable amounts of undeveloped coal, oil shale, and uranium resources, which are important in the national energy demand system. A mathematical model which simulates the salt and water exchange phase of potential fuel conversions has been developed based on a subbasin analysis identifying available mineral and water resources. Potential energy developments are evaluated with respect to the resulting impacts upon both the quantity and salinity of the waters in the Colorado River. Model solutions are generated by use of a multilevel minimum cost linear programming algorithm, minimum cost referring to the cost of developing predetermined levels of energy output. Level one in the model analysis represents an aggregation of subbasins along state boundaries and thereby optimizes energy developments over the five states of the Upper Colorado River Basin. In each of the five second level problems, energy developments over a subbasin division within the respective states are optimized. A generalized solution format is used so that changes can be made to the model which enables its application to other watersheds. Water availability represents the most important factor influencing energy development in the Colorado River. Development policies which utilize high salinity waters of the Upper Colorado River enable a net salinity reduction to be realized in the Colorado River at Lee Ferry, Arizona. Consequently, it should be possible with adequate planning to develop Upper Basin energy resources without affecting and in fact improving downstream salinity. Energy process waters returned to the river would never, degrade the waters of the Colorado River as would excessive infiltration of surface mined lands.

W77-12630

A LINEAR PROGRAMMING MODEL FOR ASSESSING THE REGIONAL IMPACTS OF ENERGY DEVELOPMENT ON WATER RESOURCES,

Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.

For primary bibliographic entry see Field 6A.
W77-12633

TECHNOLOGY AND ASSOCIATED COST FOR SULPHITE PULPING SPENT LIQUOR RECOVERY.

For primary bibliographic entry see Field 5D.

W77-12772

3F. Conservation In Agriculture

MODELING SOIL WATER MOVEMENT FOR TRICKLE IRRIGATION - PHASE II,

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

For primary bibliographic entry see Field 2G.

W77-12256

RESOURCE USE EFFICIENCY OF IRRIGATED FARMS IN BORUNDA TUBE-WELL COMMAND AREA, RAJASTHAN,

Central Arid Zone Research Inst., Jodhpur (India). D. L. Vyas.

Annals of Arid Zone, Vol. 16, No. 1, p 127-132, March, 1977. 1 tab, 13 ref.

Descriptors: *Land use, *Farm management, *Land resources, *Irrigation effects, *Irrigated land, Arid lands, Water supply, Water resources, Model studies, Irrigation water, Fertilizers, Nitrogen, Crop production, *Groundwater, Land management, Irrigation, Water utilization.

Identifiers: *India(Rajasthan).

Availability of fresh water in desert areas is crucial for augmentation of crop production. The Borunda Tube-well command area in India is an example of successful tapping of ground water resources in arid areas. As a result of this increased water supply, it is expected that use of the land will undergo significant changes. This study was conducted to document the comparative use-pattern of resources in arid areas where water has recently been made available. Data were collected from farm management investigations of twenty-five irrigated farms in this region. A single long-linear function of the Cobb-Douglas type was employed to study the magnitudes of resource use efficiency for the different inputs. The results are presented. They show that in the year of the study farmers tended to overuse labor, land, and nitrogenous fertilizer. Planners need to regulate land, labor, and fertilizer use and to introduce new crops. (Jamaica-Arizona)

W77-12279

RESEARCH ON EFFICIENT WATER USE,

Indian Agricultural Research Inst., New Delhi. Nuclear Research Lab.

For primary bibliographic entry see Field 2G.

W77-12282

EFFECT OF SALINITY AND N-FERTILIZATION ON GROWTH AND N CONTENT OF CORN,

Ministry of Agriculture, Cairo (Egypt). Soils and Water Research Inst.

For primary bibliographic entry see Field 3C.

W77-12284

IRRIGATION OF A SALINE-SODIC SITE IN THE SUDAN GEZIRA. I-WATER MOVEMENT,

Gezira Agricultural Research Station, Wad Medani (Sudan).

For primary bibliographic entry see Field 3C.

W77-12285

IRRIGATION OF A SALINE-SODIC SITE IN THE SUDAN GEZIRA. II-SALT MOVEMENT AND SODICITY CHANGES,

Soil Survey Administration, Wad Medani (Sudan).

For primary bibliographic entry see Field 3C.
W77-12286

EFFECT OF IRRIGATION REGIME UNDER SALINE CONDITIONS ON GROWTH AND YIELD OF COTTON PLANT IN CALCAREOUS SOIL,

Ministry of Agriculture, Cairo (Egypt). Soils and Water Research Inst.

For primary bibliographic entry see Field 3C.

W77-12288

EFFECT OF WATER STRESS ON $14CO_2$ FIXATION AND TRANSLOCATION IN WHEAT DURING GRAIN FILLING,

Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.

R. R. Johnson, and D. N. Moss. Crop Science, Vol. 16, p 697-701, Sept-Oct. 1976. 1 fig, 5 tab, 11 ref.

Descriptors: *Moisture stress, *Photosynthesis, Translocation, *Wheat, *Crop response, On-site investigations, Crop production, Leaves, Plant physiology, Soil-water-plant relationships. Identifiers: Grain filling, Senescence, Kernel yield.

Field studies were conducted in 1973 on two semi-dwarf wheat (*Triticum aestivum* L.) genotypes subjected to water stress causing wilting during the grain filling stage. Distribution of photosynthesis within the canopies and the translocation pattern of labeled assimilates after $14CO_2$ uptake were determined. Stress caused a reduction of 14% in kernel weight and 20% in grain yield compared to control plants. Control and stress plants were exposed to $14CO_2$ at 12, 16 and 23 days after heading; stress severity increased on the stress plots, and the photosynthesis location shifted away from the leaf lamina to the upper leaf sheaths, upper stem portions and spike. Within 24 hours after labeling, most $14C$ had been removed from leaves and sheaths; after 24 hours, grain of stressed plants contained 46% of the total shoot activity compared to 35% in controls. A relatively higher $14C$ percent was retained by the spike structures at both the 24-hour and maturity harvest when compared to other photosynthetic organs. Of the total $14C$ recovered from shoots at maturity, 69% was in the grain of control plants and 83% in stressed plants. The lower percentage in controls was due to greater $14C$ accumulation in stem segments. The relative contribution of spike structures, upper sheaths and stems to photosynthesis increased as the lower leaves became senescent. The grain appears to become a stronger sink for CO_2 assimilated later in the grain filling stage. (Jahns-Arizona)

W77-12289

RESPONSE OF SOYBEAN VARIETIES TO POTASSIUM UNDER RAINFED CONDITIONS,

Sri Venkateswara Agricultural Coll., Tirupati (India).

G. H. S. Reddi, Y. Y. Rao, C. K. Reddi, and S. V. Subbaiah.

Annals of Arid Zone, Vol. 15, No. 4, p 323-325, December, 1976, 1 tab

Descriptors: *Soybeans, *Potassium, *Crop response, Plant growth, Productivity, Height, Plant populations, Planting management, Weight, Crops, Seeds, Dry farming, Soil-water-plant relationships.

Identifiers: Improved Pelican, K16, India.

A field trial to determine the effect of three levels of potassium (0 kg, 20 kg, 40 kg) on growth and yield of two varieties of soybean (K16, Improved Pelican) was conducted. Significant varietal differences found at harvest included higher values of K16 for plant height, nodes per plant, total and filled pods per plant; and higher values of Improved Pelican for plant population and test

weight. Differences in seed yield was not significant. Differences among potassium levels were significant only with regard to plant height with maximum height observed in lowest potassium level and the minimum height in the highest level. Improved Pelican had a higher test weight than K16 at all levels of potassium. (Ullery-Arizona) W77-12294

CORRELATIONS BETWEEN RAIN AND RUN-OFF AMOUNTS AND COMPOSITION IN EASTERN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 4A.
W77-12308

EFFECTS OF SOIL, COVER CROP, AND NUTRIENT SOURCE ON MOVEMENT OF SOIL, WATER, AND NITROGEN UNDER SIMULATED RAIN-SLOPE CONDITIONS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 2B.
W77-12309

EVAPOTRANSPIRATION AND SOIL WATER MOVEMENT BENEATH THE ROOT ZONE OF IRRIGATED AND NONIRRIGATED MILLET (PANICUM MILIACEUM),
Agricultural Research Service, Florence, S.C.
For primary bibliographic entry see Field 2D.
W77-12315

WEEKLY WATER BALANCES OF NORMAL AND SEVERE DROUGHT YEARS AT DHARWAR,
University of Agriculture Sciences, Bangalore (India). Dharwar Campus.
For primary bibliographic entry see Field 2B.
W77-12332

USE OF THERMODYNAMIC POTENTIAL OF SOIL MOISTURE FOR STUDYING SOIL AND PLANT HYDROPHYSICS, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
For primary bibliographic entry see Field 2G.
W77-12471

CORRELATION OF SOIL QUALITY UNDER DIFFERENT LEVELS OF AGRICULTURE, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
For primary bibliographic entry see Field 2G.
W77-12487

A MODEL TO PREDICT TOTAL ENERGY REQUIREMENTS AND ECONOMIC COSTS OF IRRIGATION SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
K-L. Chen, R. B. Wensink, and J. W. Wolfe.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 23 p, 11 fig, 4 tab, 4 ref.

Descriptors: *Computer models, Model studies, Simulation analysis, Economics, Irrigation, *Irrigation systems, Sprinkler irrigation, Surface irrigation, *Energy, *Forecasting, *Costs.
Identifiers: Drip irrigation, Trickle irrigation.

A computer model has been developed to simulate total fossil energy requirements and economic costs for hand move, side roll, solid set, permanent, center pivot, drip and surface systems. In addition to evaluating a specific design, the analyst can direct the program to search for minimum

economic and/or minimum energy designs for a specific system. The model was used to determine the effects of static pumping lifts on minimum energy and minimum economic designs. The fossil energy utilization hierarchy was a function of pumping lifts, with the surface system the most efficient at zero-foot lift and the least efficient at pumping lifts above a few hundred feet. The economic hierarchy was also a function of pumping lifts. However, drip produced the lowest annual per acre cost at all pumping depths. The differences in annual fossil energy requirements and economic cost between energy and economic designs were relatively small. However, initial investment costs of the energy designs averaged 11.6 percent larger than the economic designs. Although economic designs annually consumed an average of 76 kilowatt-hours more electric energy than energy designs, energy designs annually cost 7.24 dollars per acre more. (Skogerboe-Colorado State) W77-12503

EFFECTS OF IRRIGATION SCHEDULING AND COORDINATED DELIVERY ON IRRIGATION AND DRAINAGE SYSTEMS,
Bureau of Reclamation, Denver, Colo. Lower Colorado Region.
R. D. Gear, A. S. Dransfield, and M. D. Campbell.
Presented at the National Water Resources and Ocean Engineering Convention of the American Society of Civil Engineers, April 5-8, 1976, San Diego, California, 17 p, 3 fig, 3 ref. ASCE Preprint 2720. \$1.00.

Descriptors: Scheduling, Irrigation, Irrigation practices, *Neutron absorption, Crop production, *Soil moisture, Soil water, Irrigation efficiency, *Drainage systems, *Irrigation systems, Soil moisture meters.
Identifiers: *Irrigation scheduling.

A simple, accurate technique has been worked out to schedule irrigations, using a graphic display of neutron probe measurements. The neutron probe design has been changed to combine the scaler with the shield and provide a useful field tool from what has traditionally been used almost exclusively for research. The technique used for scheduling irrigation requires only the identification of the refill point for each field and the neutron measured water content with time. Evidence collected from 40 fields with 7 crops during the summer of 1975 shows inconsistent irrigation timing with respect to available moisture. Consistent timing alone could improve water use efficiently by more than 10 percent. The neutron probe measurements of soil moisture depletion yield values of transient water use by plants as well as transient water loss by drainage. These two values together, divided by the water applied yield the efficiency for the field. (Skogerboe-Colorado State) W77-12504

SPRINKLER UNIFORMITY MEASURES AND SKEWNESS,
Escola de Engenharia de Sao Carlos (Brazil). Hidraulica e Saneamento.
F. H. Chaudhry.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE Vol 102, No IR4, p 425-433, December 1976. 3 fig, 14 ref.

Descriptors: *Sprinkler irrigation, *Irrigation efficiency, Irrigation systems, Irrigation design, Infiltration, *Irrigation practices.
Identifiers: Precipitation rates, *Skewness(Irrigation).

The relationships between the more popular measures of uniformity of sprinkler irrigation have been studied both theoretically and experimentally taking into account the skewness of the precipitation distribution. The theoretical results show reasonable agreement with the data. Excellent agreement in the case of pattern efficiency leads to

the conclusion that the smaller precipitations are well described by the assumed gamma distribution. The effect of skewness, in general, is to increase the pattern efficiency and the coefficient of Christiansen. The linear relationships that exist between these parameters are conditioned by the extent of skewness. This study shows that the conversion of one parameter into another which is sometimes practiced in the design of sprinkler systems may be risky if the skewness is disregarded. (Skogerboe-Colorado State) W77-12505

IRRIGATION TAILWATER LOSS AND UTILIZATION EQUATIONS,
Southwestern Great Plains Research Center, Bushland, Tex.
A. D. Schneider.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE Vol 102, No IR4, p 461-464, December 1976. 2 fig, 4 ref.

Descriptors: *Tailwater, Irrigation, *Furrow irrigation, Surface irrigation, Irrigation systems, Return flow, *Irrigation efficiency, *Irrigation water.

Allowing irrigation tailwater runoff is the commonly accepted practice for fully irrigating the lower end of graded furrows or borders. Irrigation-system water losses are minimized by proper balance between tailwater losses and deep percolation losses. Criddle, et al. (1956) recommended an irrigation advance time equal to one-fourth of the application time. To reduce tailwater losses, they recommended a 'cutback' furrow stream during the latter part of the irrigation set. Irrigation tailwater recovery systems can reduce the water losses that occur without a cutback furrow stream. Bondurant presented design criteria for tailwater recovery systems and recommended operating the systems to achieve a reduced furrow stream input. A knowledge of the relative importance of design variables and the ability to place bounds on tailwater loss and recovery aids the engineer with limited design information. Equations that show the relative importance of the variables affecting tailwater loss and utilization are presented. (Skogerboe-Colorado State) W77-12506

AUTOMATION OF ON-FARM IRRIGATION TURNOUTS UTILIZING JACK-GATES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
A. R. Dedrick, and L. J. Erie.
Paper No. 76-2049, Presented at the 1976 Annual Meeting of the American Society of Agricultural Engineers, June 27-30, 1976, Lincoln, Nebraska. 16 p, 6 fig, 3 tab, 7 ref.

Descriptors: Basins, Irrigation, *Irrigation systems, Irrigation efficiency, *Irrigation practices, Automation, Flood irrigation, Surface irrigation, *Gates.
Identifiers: Basin irrigation, *Jack-gates.

A 26.3 ha (65-acre) field, divided into eight level basins that are independently irrigated from a centrally-located concrete-lined canal using single outlet jack-gates, has been automated with pneumatic controls and air cylinders. The system has been successfully operated for 14 irrigation cycles (May 1975 through May 1976). The last 12 irrigations were completed by the farmer and/or his irrigator without assistance from the developers/researchers. (Skogerboe-Colorado State) W77-12507

UNIFORMITY OF DISTRIBUTION IN UNDERTREE IRRIGATION IN ORCHARDS,
Technion - Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
D. Karmeli, and W. K. Walker.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

Paper No 76-2012, Presented at the 1976 Annual Meeting of the American Society of Agricultural Engineers, June 27-30, 1976, Lincoln, Nebraska. 14 p, 3 fig, 2 tab, 6 ref.

Descriptors: *Sprinkler irrigation, Irrigation efficiency, Irrigation systems, Irrigation, Uniformity, *Orchards, *Distribution.
Identifiers: Foliage density, *Irrigation uniformity.

Sprinkler uniformity was evaluated in two citrus orchards using nozzles of varying angles. Results were analyzed using the Christiansen Uniformity Coefficient as well as the wetting zone technique. The effects of nozzle angle as well as foliage density were determined. (Skogerboe-Colorado State) W77-12508

A LOOK AT CROP YIELDS ALONG THE COLORADO IN 2000 AD,

California Univ., Davis. Dept. of Land, Air and Water Resources.

F. E. Robinson.

In: 1976 Annual Technical Conference Proceedings, Sprinkler Irrigation Association, Technology for a Changing World, February 22-24, 1976, Kansas City, Missouri, p 131-132. 13 ref.

Descriptors: Technology, Irrigation, *Crop production, *Colorado River basin, *Sprinkler irrigation, Irrigation efficiency.

Technology is advancing into the changing world and is propelled from many directions. This change could improve crop yields along the Colorado River because of improved uniformity of the sprinkling and precision placement. (Skogerboe-Colorado State) W77-12509

MANAGEMENT FOR OPTIMUM EFFICIENCY, Texas A and M Univ., College Station. Dept. of Agricultural Engineering.

T. A. Howell.

In: 1976 Annual Technical Conference Proceedings, Sprinkler Irrigation Association, Technology for a Changing World, February 22-24, 1976, Kansas City, Missouri, p. 79-88. 1 fig, 7 tab, 7 ref.

Descriptors: Irrigation water, *Irrigation efficiency, Agriculture, Crop production, *Water quality, *Optimization, Dynamic programming, Model studies, *Water management (Applied), Water supply. Identifiers: High frequency irrigation.

The proper utilization of natural resources has never held a more prominent position in our society than now. The influence and effects of water on the world food supply are extremely important. The irrigation water utilized in agriculture in the future will probably be much lower in quality and quantity than that in present use. The proper management of these water supplies will become increasingly important. Use of high frequency irrigation to maximize a crop yield with a limited quantity of irrigation water is described. The purpose was to utilize existing soil water and precipitation in conjunction with supplemental high frequency irrigation to increase crop yields. The specific objectives were to optimize the irrigation decisions under high frequency irrigation so that the maximum yield was obtained with a given quantity of irrigation water. Dynamic programming was used to optimize the multi-stage decision problem. System simulation was utilized to simulate the stochastic state transitions. (Skogerboe-Colorado State) W77-12510

OPERATING LARGE TRAVELING 'GUN' SPRINKLERS IN WINDS,

Agricultural Research Service, Morris, Minn. North Central Soil Conservation Research Center. H. Shull, and A. S. Dylla.

Paper No. 76-2014, Presented at the Annual Meeting of the American Society of Civil Engineers, June 27-30, 1976, Lincoln, Nebraska. 11 p, 5 tab, 8 ref.

Descriptors: Winds, *Wind velocity, *Irrigation efficiency, Uniformity, Irrigation systems, *Sprinkler irrigation, *Minnesota, Operations.

Studies of the wind distortion of water application patterns from large single-nozzle 'gun' irrigation sprinklers in west central Minnesota, where high winds are prevalent during the irrigation season, show that wind adversely affects the application pattern. When 'gun' sprinklers are used as traveling sprinklers, there is no acceptable travel lane spacing that will give a Christiansen (1942) Uniformity Coefficient (Cu) value of 85% or greater under all of the wind conditions to be expected in windy areas. Acceptable water application uniformity can be achieved with wind velocities up to about 8 m/sec (18 mi/hr) if the travel lane spacing is reduced to about 25% of the no wind wetted diameter for the sprinkler, an unacceptable solution. Limiting irrigation to periods when the wind velocity does not exceed about 4 m/sec, and the wind direction is normal to the travel lane direction, will usually produce a Cu value of 85% or more. In some areas average daytime winds exceed 4 m/sec (9 mi/hr) during the cropping season; however wind velocity usually decreases at night. If night irrigation is possible it will provide a higher Cu value than daytime irrigation because of the reduced wind velocity. If an operator has a choice of travel land direction, the direction should be normal to the prevailing wind direction. (Skogerboe-Colorado State) W77-12511

EVAPORATIVE COOLING OF PEACH TREES TO BREAK REST AND DELAY BLOOM,

Georgia Univ., Athens. Dept. of Agricultural Engineering.

J. L. Chesness, C. H. Hendershott, and G. A. Couvillon.

Paper No. 76-2039, Presented at the Annual Meeting of the American Society of Civil Engineers, June 27-30, 1976, Lincoln, Nebraska. 12 p, 2 fig, 3 tab, 10 ref.

Descriptors: *Peaches, Orchards, *Sprinkler irrigation, *Evaporation, Irrigation systems, Irrigation effects, Irrigation practices, *Model studies, Forecasting.
Identifiers: *Evaporative cooling (Peach trees), *Utah Pheno-Climatology model.

The Utah Pheno-Climatology Model was used to predict rest completion and bloom dates for Loring Peach Trees. Individual tree sprinklers with an application rate of .086 per hour (.218 cm/hr) were utilized over a 31-day period to achieve a 14-day bloom delay. (Skogerboe-Colorado State) W77-12512

FEASIBILITY OF USING SOLAR ENERGY TO DRIVE IRRIGATION PUMPS,

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

D. L. Larson, C. D. Sands, II, C. Towle, Jr., and D. D. Fangemeier.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 18 p, 5 fig, 8 tab, 15 ref.

Descriptors: Irrigation, *Irrigation practices, *Solar radiation, Project planning, Irrigation engineering, Energy, Economics, *Pumps. Identifiers: *Irrigation pumps, *Solar energy.

The technical and economic feasibility of using solar energy to drive irrigation pumps have been studied to determine the conditions required for serviceable, competitive use of solar systems.

Solar power plant component development, changes in irrigation and pumping practices, investment incentives and higher fuel prices may all be required for economical use of solar energy. (Skogerboe-Colorado State) W77-12513

WEED MANAGEMENT TOOL HERBIGATION FOR IRRIGATED CROPLAND,

Nebraska Univ., Lincoln.

W. Siefert.

Crops and Soils Magazine, Vol. 28, No. 5, p 10-11, February 1976. 2 fig, 1 tab.

Descriptors: *Weed control, *Herbicides, Crop production, Irrigation, Irrigation practices, Irrigation systems, Irrigation water. Identifiers: *Herbigation.

If you irrigate, you have a good alternative to conventional ground or air chemical applications for weed control. The alternative is herbigation—applying herbicides through the irrigation system. Herbigation has been researched for several years and is gaining acceptance among irrigators. Good results can be obtained with herbigation in any type of irrigation system. (Skogerboe-Colorado State) W77-12515

REMOTE SENSING OF SOIL MOISTURE. For primary bibliographic entry see Field 2G.

W77-12516

LOW-COST 'BUBBLER' IRRIGATION SYSTEM DEVELOPED.

Irrigation Journal, Vol. 26, No. 4, p 30, July-August 1976. 2 fig.

Descriptors: Irrigation, *Irrigation systems, Irrigation efficiency, Water conservation, Costs. Identifiers: *Bubbler irrigation, Gravity irrigation.

A simply installed, low-cost, low-pressure nearly maintenance-free system of 'bubbler' irrigation for tree crops is described. (Skogerboe-Colorado State) W77-12517

COMPUTERIZED IRRIGATION SCHEDULING METHOD MAY SAVE FARMERS MILLIONS OF DOLLARS.

Irrigation Journal, Vol. 26, No. 5, p 24-25, September-October 1976. 1 fig.

Descriptors: Irrigation, *Irrigation practices, Water conservation, *Computer programs. Identifiers: *Irrigation scheduling.

A new computerized method of irrigation scheduling which could result in a 30 to 35 percent savings in the state's water and energy requirements for irrigation has been put on the Agriculture Computer Network (AGNET) by University of Nebraska-Lincoln agricultural engineers. (Skogerboe-Colorado State) W77-12518

LOW-COST 'BUBBLER' DEVELOPED.

Irrigation Age, Vol. 11, No. 1, p 20, September 1976.

Descriptors: Irrigation, Irrigation systems, *Irrigation efficiency, Water conservation. Identifiers: *Bubbler irrigation, Gravity irrigation.

A simply installed, low-cost, low-pressure nearly maintenance-free system of 'bubbler' irrigation for tree crops is described. (Skogerboe-Colorado State) W77-12519

SPOON-FEEDING NITROGEN.

Irrigation Age, Vol. 11, No. 1, p 18-19, September 1976. 3 fig.

Descriptors: *Nitrogen, *Nutrients, Fertilizers, *Fertilization, Crop production, Corn(Field), Absorption.

Producing a bushel of corn with one pound of fertilizer requires accurate soil and water testing, skillful programming and a good understanding about nutrient uptake of the corn plant. That is why a Colorado farmer is concentrating on three areas which can help hedge against yield-depleting adversities: more efficient nutrient programming, better water scheduling and improved tillage techniques. (Skogerboe-Colorado State) W77-12520

DRIP/TRICKLE IRRIGATION GENERATING GROWTH, OPTIMISM,

R. Ross.
Irrigation Age, Vol. 11, No. 3, p 14-16, November-December 1976. 1 fig.

Descriptors: Irrigation, *Irrigation practices, Irrigation systems, Water conservation, Irrigation efficiency.

Identifiers: *Drip irrigation, *Trickle irrigation.

Irrigation Age, in a series of personal interviews during the International Drip Irrigation Association meeting, spoke to several representatives of various drip/trickle industry segments. (Skogerboe-Colorado State) W77-12521

LOW-COST SAND AND GRAVEL SEPARATOR,
Agricultural Research Service, Kimberly, Idaho.
Snake River Conservation Research Center.
S. Humpherys.

Irrigation Age, Vol. 11, No. 3, 1 p.
November/December 1976. 2 fig.

Descriptors: Filtration, Irrigation, Sprinkler irrigation, *Irrigation practices, Sands, Gravels.
Identifiers: *Sand separators, Centrifugal separators.

Many wells supplying sprinkler systems produce sand and small gravel in varying amounts and sizes. Sand and gravel particles lodge in the sprinkler nozzles and plug them. Anyone with such a well knows that continually unplugging nozzles can be exasperating. Also, plugged nozzles affect water distribution and sand in the water increases nozzle wear. Raymond Humpherys and his son, Jerry, who sprinkle irrigate their dairy farm in Star Valley, Wyoming, experienced this problem. To solve the problem, they purchased a 58-inch diameter, 442 gallon buoy tank from a military surplus disposal year for less than \$100. They connected the buoy to the buried pipeline from their pump as shown in the drawing. The 10-inch inlet pipe was welded into the tank just below mid-height and close to one side. The outlet pipe was welded into the tank near the top. Water flowing through system creates circulation motion causes a centrifugal force which moves the heavier particles to the outside where the water velocity is lower. The particles then settle to the bottom and accumulate in the center. (Skogerboe-Colorado State) W77-12522

SUBTERRANEAN IRRIGATION, A SPECIAL REPORT ON THE PAT, INC. SYSTEM,

D. Morey.
Irrigation Journal, Vol. 26, No. 1, p 16-18, January-February 1976. 4 fig.

Descriptors: Irrigation, Irrigation practices, *Subsurface irrigation, Turf, *Turf grasses, *Irrigation efficiency, *Irrigation systems.

The PAT System (Prescription Athletic Turf) involves the scientific construction of playing surfaces of natural turf and soil over a prescribed mixture of sand to a depth of 16 to 24 inches. Then a network of plastic pipe, with slits at uniform intervals, connected to suction pumps controls the water flow (either off the field or onto the root zone for irrigation). Electric heating cables can also be provided which will extend the frost-free season and lengthen the turf growing season. Underneath all this is the plastic sheeting which creates the barrier against underground water rising to the playing surface. Presently this is a special ten-mil thick vinyl sheeting welded together in massive sheets which are gate folded before movement from the factory to the construction site. Properly engineered and technically constructed, the PAT System promises to offer the answer to the many faults of artificial turf and to provide a fine natural turf playing surface for an extended season that can take a real beating without showing the damage of athletic fields of yesterday. (Skogerboe-Colorado State) W77-12523

ONE DROP AT A TIME,

D. Flaherty.
Quest, Vol. 12, No. 4, p 4-9, Winter-Spring 1976. 8 fig.

Descriptors: Irrigation, *Irrigation systems, Irrigation practices, *Irrigation water, Filters, Filtration.
Identifiers: *Drip irrigation, Trickle irrigation.

With multiple demands increasing for a finite supply of water, the drip system of irrigation has a lot more to offer, once some problems are solved. Engineers and Scientists at Washington State University are working on the problems. (Skogerboe-Colorado State) W77-12525

BUDGET FOR YOUR NITROGEN IDEAL SUGARBEETS,

Great Western Sugar Co., Longmont, Colo.
D. G. Westfall.
Crops and Soils Magazine, Vol. 28, No. 5, p 12-14, February 1976. 3 fig.

Descriptors: *Nitrogen, Nutrients, Fertilizers, *Fertilization, *Sugarbeets, Crop production, Agriculture.

This budget technique is a foolproof way of determining the fertilizer recommendation for sugarbeets that is a vital link in efficient production. By using this technique, you no longer have to apply nitrogen fertilizer blindly. You have a technique that has proven itself by reaching the compromise of optimum yield of high sugar content sugarbeets. (Skogerboe-Colorado State) W77-12526

NITROGEN NOW AND TOMORROW,

J. H. Parker.
Crops and Soils Magazine, Vol. 28, No. 8, p 12-14, June-July 1976.

Descriptors: *Nitrogen, Fertilizers, Fertilization, Nutrients, Forecasting, Crops.

We can expect to continue to have nitrogen fertilizers in the future. The dominance of natural gas as a feedstock for ammonia production will diminish, being supplemented by coal late in this century. Further in the future, processes based on nuclear electricity and/or heat may become dominant. Other approaches that now appear exotic could assume significance if researchers are able to manipulate nature's secrets successfully. But we can still face the possibility of short-term scarcities when we have fast-changing market conditions. (Skogerboe-Colorado State) W77-12527

BAND APPLICATION: A BETTER LESS COSTLY WAY TO FERTILIZE YOUR CROPS,

G. E. Richards.
Crops and Soils Magazine, Vol. 28, No. 9, p 10-11, August/September 1976.

Descriptors: Fertilizers, *Fertilization, Nutrients, *Crop production, Agriculture.
Identifiers: *Band application(Fertilization).

Band application of phosphatic fertilizer or a combination of band plus broadcast is the most efficient and most profitable way to apply fertilizer over both the long or short term. Band application of phosphorus takes less fertilizer. Banding reduces fertilizer costs, interest costs, and application costs. It may also reduce fuel costs. Banding extends planting time by only 30 seconds per acre. (Skogerboe-Colorado State) W77-12528

NEW ROW CROP DRIP IRRIGATION USE,

California Univ., San Diego, La Jolla.
B. J. Hall.
Drip/Trickle Irrigation, Vol. 1, No. 1, p 26-27, June 1976. 5 fig.

Descriptors: Irrigation, *Irrigation practices, Irrigation systems, Crop production, *Irrigation efficiency.

Identifiers: *Drip irrigation, Trickle irrigation, Row crops.

The increase of drip irrigation over furrow application for row crops was substantial last year, and it will make real inroads in 1976. Drip irrigation is expanding rapidly in crops of staked tomatoes, strawberries, cucumbers, squash, peppers, and soft squash. In San Diego County, tomatoes were irrigated last year with several drip irrigation systems, and this year two to three thousand acres will be in drip irrigation. Over 50 percent of the strawberry plantings in California are in drip irrigation. The use of drip irrigation will expand into new lower gross income crops for water savings and other benefits. (Skogerboe-Colorado State) W77-12529

SALINITY MANAGEMENT WITH DRIP IRRIGATION,

Agricultural Research Service, Riverside, Calif.
Salinity Lab.
For primary bibliographic entry see Field 3C.
W77-12530

NEW 'LATERAL MOVE' SPRINKLER CUTS NO CORNERS,

J. Schleicher.
Irrigation Age, Vol. 11, No. 1, 3 p, September 1976. 3 fig.

Descriptors: *Sprinklers, *Sprinkler irrigation, Irrigation, Irrigation practices, *Corn(Field).

A new sideroll sprinkler system has been developed to irrigate corn. (Skogerboe-Colorado State) W77-12531

LATE SUMMER IRRIGATION AND ESTABLISHMENT OF WINTER ANNUAL LEGUMES IN A MEDITERRANEAN-TYPE CLIMATE,

California Univ., Davis. Dept. of Agronomy and Range Science.
K. L. Taggard, R. E. Delmas, and C. A. Raguse.
Agronomy Journal, Vol. 68, No. 4, p 674-677, July-August 1976. 3 tab, 7 ref.

Descriptors: *Legumes, Clovers, *Grasses, Ryegrass, Irrigation, Irrigation effects, *Irrigation practices, California.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

Winter annual legumes have low fall and early winter forage yields in California's Mediterranean-type climate. A 2-year field study was conducted to determine the effects of late summer irrigation on seedling development, forage yield potential, and management problems of subterranean clover, rose clover, and bur clover. A mixture of three annual grasses, slender wild oats, and annual ryegrass, and a natural stand of indigenous species were included in the study for comparison. By irrigation prior to fall rains, we subjected six successive seedlings, 2 weeks apart, to higher temperatures and longer fall-growth periods than usual. (Skogerboe-Colorado State)
W77-12532

HIGH-FREQUENCY TRICKLE IRRIGATION AND ROW SPACING EFFECTS ON YIELD AND QUALITY OF POTATOES,
Agricultural Research Service, Florence, S.C.
C. J. Phene, and D. C. Sanders.
Agronomy Journal, Vol. 68, No. 4, p 602-607, July-August 1976. 6 fig, 4 tab, 15 ref.

Descriptors: *Potatoes, Irrigation, *Irrigation practices, *Crop production, Soil water stress, *Soil water, Soil moisture.
Identifiers: High frequency irrigation, Drip irrigation, *Trickle irrigation.

Soil water is a major limiting factor in the production and quality of potatoes. The objectives of this research were to determine the effects of trickle irrigation under controlled soil matrix potential and two row spacings on the yield, quality, and nutrient contents of potatoes. Potatoes, trickle irrigated with nutrient solution and grown on 100-cm row spacing on sandy loam soil, yielded 76% more marketable potatoes than those trickle irrigated under a plastic mulch and grown on twin row spacing and 206% more than 100-cm spaced, nonirrigated potatoes. (Skogerboe-Colorado State)
W77-12533

EFFECT OF LEAF SHAPE ON RESPONSE OF COTTON TO PLANT POPULATION, N RATE, AND IRRIGATION,
Georgia Univ., Athens. Dept. of Agronomy.
M. J. Rao, and J. B. Weaver Jr.
Agronomy Journal, Vol. 68, No. 4, p 599-601, July-August 1976. 4 tab, 8 ref.

Descriptors: *Leaves, *Cotton, Crop response, Irrigation, *Irrigation practices, *Nitrogen, Fertilization.

Leaves varying in shape have been identified in cotton, and it has been conjectured that leaf shape affects growth and other quantitative characters in Upland cotton. The objective of these studies was to evaluate okra and normal leaf shape on boll rot, yield, earliness, boll size, and fiber properties. Near isogenic lines of okra and normal leaf shape cotton was evaluated at three plant populations and three N rates on an Appling coarse sandy loam soil over a 3-year period 1971-73. In 1972 irrigation treatments were also included. No significant interactions were found between leaf characters, plant populations, N rates, and irrigation. Okra leaf shape increased earliness, boll size, and micronaire and decreased seed cotton loss due to boll rot. With increasing plant populations, lint yield and earliness tended to increase and boll size decreased. Higher boll rot loss was observed at higher levels of N. Irrigated cotton produced significantly greater lint yield, boll size, and fiber length and increased earliness. (Skogerboe-Colorado State)
W77-12534

FERTILIZER AND CHEMICAL INJECTION,
D. Schnedl.
Drip/Trickle Irrigation, Vol 1, No 3, p 23-25, October 1976.

Descriptors: *Fertilizers, *Fertilization, Nutrients, Irrigation, Irrigation practices, Irrigation water.
Identifiers: *Chemical injection(Fertilizers).

The methods in general use for fertilizer and chemical feeding, in order of increasing preference, are: (1) Simple metering into the irrigation water (2) Use of a venturi/bypass system (3) A metering pump (4) Proportionate feeding, using a pump, pulse-generating flow meter and counter/timer control unit and (5) Proportionate feeding using a pump, flow meter with pulsed output and an SCR/variable speed DC drive. The discussion applies to fertilizers, herbicides, algicides, chlorine and other chemicals. (Skogerboe-Colorado State)
W77-12535

DRIP SYSTEM APPLIES PHOSPHORUS.
Irrigation Journal, Vol 26, No 1, p 24, January-February 1976.

Descriptors: Irrigation, Irrigation practices, *Phosphorus, Nutrients, Fertilizers, *Fertilization.
Identifiers: *Drip irrigation, Trickle irrigation.

Results from recent University of California studies show that injection of phosphorus fertilizer through a drip irrigation system may be more feasible than commonly thought. (Skogerboe-Colorado State)
W77-12536

MINIMUM ENERGY DESIGNS FOR SELECTED IRRIGATION SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
K. L. Chen, J. W. Wolfe, R. B. Wensink, and M. A. Kizer.
Paper No. 76-2037, Presented at the Annual Meeting of the American Society of Civil Engineers, June 27-30, 1976, Lincoln, Nebraska. 22 p, 7 fig, 5 tab, 6 ref.

Descriptors: Computer programs, Model studies, Simulation analysis, Irrigation, *Irrigation systems, *Irrigation efficiency, *Energy, Model studies, Surface irrigation, Sprinkler irrigation, *Computer models, Design criteria.
Identifiers: Energy conservation.

A computer model has been developed which simulates the total energy requirement and determines the designs requiring minimum energy consumption for various irrigation systems. The model simulates each system by modularizing its energy needs into four basic areas: installation, operation, transportation, and manufacturing. The model considers the total, non-renewable energy resources used in the form of fossil fuel. Simulation model output determined the following relatively consistent energy utilization hierarchy among the irrigation systems: surface, drip, side roll, hand move, center pivot, permanent, and solid set systems. The effects of field size on minimum energy requirements for each irrigation system were relatively small but indicated that solid set and permanent designs should be based on small scale fields, that hand move and side roll designs reached minimum requirements with 80-acre fields, and that drip and surface systems' energy requirements remained relatively constant as the field sizes were varied from 20 to 160 acres. (Skogerboe-Colorado State)
W77-12537

THE DEVELOPMENT OF A FURROW-MULCH RIDGER,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
C. B. Richey, and D. R. Griffith.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December

14-17, 1976, Chicago, Illinois. 18 p, 7 fig, 3 tab, 16 ref.

Descriptors: *Furrow irrigation, Surface irrigation, Erosion, Erosion control, Furrows, Flow resistance, Soybeans, *Mulching, *Cultivation, Weed control, Plant growth.
Identifiers: *Furrow-mulch ridger.

A tillage tool to form ridges for row crops but leave residue on the surface in the furrows has been developed. It gives promise of combining early plant growth and weed control approaching plowing with moisture conservation and erosion control approaching the no-till system. (Skogerboe-Colorado State)
W77-12538

ANALYSIS OF HIGH FREQUENCY FURROW IRRIGATION,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
W. R. Walker, and J. Gerards.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 12 p, 5 fig, 2 tab.

Descriptors: *Furrow irrigation, Surface irrigation, Irrigation, *Irrigation systems, Irrigation practices, Infiltration.
Identifiers: *High frequency furrow irrigation.

The possibility of high frequency furrow irrigations is explored. Field data demonstrate the difficulty in evaluating infiltration parameters. Analyses of results indicate a number of advantages in high frequency furrow irrigations. (Skogerboe-Colorado State)
W77-12539

THE EFFECT OF EROSION ON THE WATER AND PHYSICOCHEMICAL PROPERTIES OF SOIL ON THE ALTAI MOUNTAIN SLOPES NEAR THE OB RIVER (USSR), (IN RUSSIAN),
Altiskii Nauchno-Issledovatel'skii Institut Sel'skogo Khozyaystva, Barnaul (USSR).
For primary bibliographic entry see Field 2J.
W77-12543

TWO-DIMENSIONAL MODEL OF EROSION FROM A WATERSHED,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W77-12575

CORN-SOYBEAN TILLAGE SYSTEMS: EROSION CONTROL, EFFECTS ON CROP PRODUCTION, COSTS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
J. C. Siemens, and W. R. Oschwald.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 30 p, 7 fig, 23 tab, 12 ref.

Descriptors: Erosion, Runoff, *Crop production, *Corn(field), *Soybeans, Soil erosion, Economics, *Cultivation, *Erosion control, Costs.
Identifiers: *Tillage practices.

Seven tillage systems for producing corn and soybeans were compared in terms of erosion control, effects on crop production, and cost. Conservation tillage systems greatly reduced soil erosion. Yields were sometimes less with conservation tillage. Total costs for the different systems were equivalent. (Skogerboe-Colorado State)
W77-12576

MISCIBLE DISPLACEMENT IN SOILS,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Conservation In Agriculture—Group 3F

For primary bibliographic entry see Field 2G.
W77-12577

SOLUTIONS TO GREEN-AMPT INFILTRATION EQUATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W77-12578

WATER-TABLE MANAGEMENT,
Soil Conservation Service, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-12580

DRAINAGE PRACTICE IN IMPERIAL VALLEY, CALIFORNIA,
Agricultural Research Service, Brawley, Calif. Imperial Valley Conservation Research Center.
For primary bibliographic entry see Field 4A.
W77-12581

RUNOFF AND SOIL EROSION ON SLOPES DEPENDING ON CULTIVATED CROPS, (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatel'skii Institut Kukuruzny, Dnepropetrovsk (USSR).
For primary bibliographic entry see Field 2J.
W77-12587

IRRIGATION MANAGEMENT OF SHORT-SEASON, HIGH-DENSITY COTTON,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
R. A. Mohammed, and D. D. Fangmeier.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 9 p, 4 tab, 17 ref.

Descriptors: Irrigation, *Irrigation systems, *Cotton, *Soil moisture, Soil water, *Crop production, Crop response, Nutrients, Fertilization, Nitrogen, Water management (Applied).
Identifiers: *Irrigation scheduling.

An available soil moisture depletion of 50 to 55% at irrigation will give the highest yields for short-season, high-density cotton. This is compared to about 65% for conventional cotton. Changing the scheduling criteria during the season tended to reduce yields. Application of 100 pounds of N per acre appears adequate for the soils studied. This provided adequate nitrogen for plant growth but did not result in high petiole nitrate values late in the season. For highest yields irrigation termination should be based on observations of boll load and maturity. Later irrigations tend to delay boll opening while terminating too early reduces yields and fiber quality. Careful monitoring of soil moisture and plant condition is both necessary and satisfactory for irrigation scheduling. With experience, feel and appearance of soil moisture condition were adequate for irrigation scheduling. Other methods were more expensive and time consuming but were no better than field observations. Yields were comparable to those obtained with conventional cotton. Water requirements were similar to those for conventional cotton. Early termination reduced the number of irrigations by one and in 1974 reduced the yield by 17%. (Skogerboe-Colorado State)
W77-12607

ESTIMATING SEEPAGE LOSSES FROM CANAL SYSTEMS,
Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center.
For primary bibliographic entry see Field 4A.
W77-12608

UNIFORM SLURRY SPREADING WITH A CENTER PIVOT IRRIGATION SYSTEM,
Valmont Industries, Inc., Valley, Nebr.
For primary bibliographic entry see Field 5D.
W77-12612

OPTIMIZATION OF WATER USE FOR IRRIGATION,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
J. M. Van Deman, R. S. Sowell, and R. E. Sneed.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 20 p, 15 tab, 5 ref.

Descriptors: *Computer programs, *Computer models, Irrigation, *Water requirements, Linear programming, *North Carolina, *Irrigation water, Crop production, Soils, *Optimization, *Water utilization.

A computer system has been developed for determining optimal use of a limited supply of water for the irrigation of crops. The system includes: a computer program which determines water requirements of a particular crop/soil/irrigation policy combination; a linear program; a computer program to reduce data to the input format required by MPS/360; an MPS/360 program for solution of the linear program; and a computer program to reduce the MPS/360 solutions to user oriented output reports. This system was used in a study of optimal water use in a county in eastern North Carolina. Results of the study indicate the potential of increased return from agriculture by optimally using water available for irrigation. (Skogerboe-Colorado State)
W77-12617

DRAINAGE PROGRESS AND PROBLEMS ON THE COLUMBIA BASIN PROJECT,
Bureau of Reclamation, Othello, Wash.
For primary bibliographic entry see Field 8A.
W77-12618

POLLUTION PROBABILITY ESTIMATED BY SMALL STORM FREQUENCY,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W77-12620

THE CORNER SYSTEM - A VARIABLE RADIUS CENTER PIVOT SYSTEM,
Valmont Industries, Inc., Valley Nebr. Irrigation Products Div.
R. L. Frankenstein.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 12 p, 5 fig.

Descriptors: *Sprinkler irrigation, Irrigation practices, *Irrigation systems, Irrigation efficiency, Irrigation engineering.
Identifiers: *Center pivot irrigation systems.

A center pivot irrigation system has been developed that distributes water considerably beyond the reach of previous center pivots—thus, allowing the irrigation of square, rectangular, and other non-circular field shapes. The system consists of an additional 'swing span' attached to the end of the basic center pivot that extends and retracts to conform to field boundaries. The additional pipeline, the swing span, is supported by one steerable drive unit that is guided around the field, in and out of corners, by tracking a signal emitted by a buried signal wire. Sprinklers along the swing arm are controlled automatically to provide uniform water distribution under all parts of the system. This new concept of self-propelled irrigation allows over 96% field coverage in most situations. The various technologies that were utilized in developing the 'Variable Radius Center Pivot

System' are discussed. (Skogerboe-Colorado State)
W77-12621

GRASSLAND RENOVATION - CONSERVES SOIL AND ENERGY AND INCREASES RETURNS FROM GRASS FIELDS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W77-12622

FOOD PRODUCTION POTENTIAL FROM HOME GARDENS,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
S. W. Smith, and W. R. Walker.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 11 p, 3 fig, 2 tab, 5 ref.

Descriptors: *Food abundance, Foods, Mulching, *Crop production.
Identifiers: *Drip irrigation, *Home gardens, Food production.

Developments in American agriculture are often applicable to home gardens. Technologies such as drip irrigation, mulching with black polyethylene sheeting, and intensive cultivation practices may be utilized by the gardener. Through these technologies the necessary labor input can be minimized and even a small garden can materially offset a family's food budget. (Skogerboe-Colorado State)
W77-12623

VERY-LOW-PRESSURE SPRINKLER IRRIGATION,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
C. M. Burt, and J. Keller.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 24 p, 8 fig, 4 tab, 4 ref, 1 append.

Descriptors: *Sprinkler irrigation, Irrigation, Irrigation systems, *Irrigation practices, Irrigation engineering.
Identifiers: *Sprinklers.

Tests were conducted on the available sprinklers which can be operated at pressures of less than 4/3 atmosphere. Operating characteristics and design recommendations for the 'best sprinkler' from each of the four types of very-low-pressure, VLP, sprinklers are presented. The four types include: spray heads, perforated pipe, reaction rotated sprinklers, and impact rotated sprinklers. The impact sprinkler appears to be superior for VLP operation and merits further development effort. (Skogerboe-Colorado State)
W77-12624

CONSERVATION TILLAGE - EFFECTS ON CROP PRODUCTION AND SEDIMENT YIELD,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
J. V. Mannering, C. B. Johnson, and R. Z. Wheaton.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 16 p, 11 tab, 10 ref.

Descriptors: *Soil erosion, Crop response, *Crop production, Erosion, *Corn(Field), *Soybeans, *Cultivation.

Although tillage systems that leave appreciable crop residues on the surface effectively reduce soil erosion, they can result in reduced crop yields on poorly drained soils. Data are presented that illustrate the erosion control effectiveness of vari-

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ous tillage systems following corn and soybeans. (Skogerboe-Colorado State)
W77-12626

EVALUATION OF NONUNIFORMITY IN IRRIGATION AND YIELD.
Academy of Agricultural Sciences, Sofia (Bulgaria). Agrophysics Lab.
I. Varlev.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE, Vol 102, No IRI, p 149-164, March 1976. 6 fig, 1 tab, 15 ref.

Descriptors: Irrigation, Irrigation effects, Irrigation practices, *Irrigation efficiency, *Crop production, Infiltration, *Uniformity coefficient, Evaluation.
Identifiers: *Nonuniformity.

The nonuniformity of water distribution over an irrigated area is one of the basic features for evaluation of irrigation quality. It has been established, that nonuniformity of distribution influences crop yield from different parts of an irrigated field. The quantitative evaluation of nonuniformity in irrigation water distribution and its' effect on crop yield and average infiltrated depth are discussed. For definite relationships between the depth of infiltrated water and yield crop, for arid, humid, and subhumid zones, a coefficient of the nonuniformity is defined, characterizing both nonuniformity and yield depression caused by nonuniformity of irrigation-water distribution. (Skogerboe-Colorado State)
W77-12628

DRIP IRRIGATION - WORLDWIDE 1975 PRESENT STATUS AND OUTLOOK FOR DRIP IRRIGATION.
California Univ., San Diego, La Jolla.
C. D. Gustafson.
In: 1976 Annual Technical Conference Proceedings, Sprinkler Irrigation Association, Technology for a Changing World, February 22-24, 1976, Kansas City, Missouri, p 58-65.

Descriptors: Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Orchards, Crop production.
Identifiers: *Drip irrigation, *Trickle irrigation.

The response from over 100 sources throughout the world where drip irrigation is being used, provides a good up-to-date on what is happening in the use of this new method of irrigation. In areas of short rainfall, short supply of water and poor quality of water, drip irrigation has caused considerable interest. In areas of high rainfall, but occurring during a short period, supplemental irrigation with drip is being used. Where water costs are high (\$50-\$135/acre foot) and where orchards, vineyards and vegetable fields are planted on hill-sides, there is great interest in drip irrigation. In areas of abundant water of low cost and high quality, there is very little interest in drip irrigation. Where terrain is steep, labor expensive and somewhat unavailable and water quality marginal, drip irrigation is being used. Drip irrigation is not a panacea - is not for every person, on every crop or on every soil or under every condition. Drip irrigation is just another way of irrigation, along with basin, flood, furrow and sprinkler.
W77-12629

IRRIGATION PURGE VALVE.
W. S. Oman.
U.S. Patent No 4,022,244, 4 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 593, May 10, 1977.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, Valves, Drainage practices, Equipment.
Identifiers: Purge valves.

It is normal practice in large irrigation systems to provide purge valves at the terminal ends of the lateral irrigation pipes. These valves permit water to flush from the ends of the laterals under low pressure conditions. When the pressure in the irrigation system reaches a given value or exceeds this value, the purge valves automatically close so that normal irrigation operations can take place. By using purge valves, the lines are cleaned of sediment and the water is simply drained from the irrigation system when not in use. The present invention provides for an improved purge type valve. It has an internally threaded cylindrical cap having a closed end except for a single small opening. An annular shoulder within the cap is arranged to seat a resilient disc. This disc has a single opening, the opening in the closed end of the cap and the opening in the disc being radially off-set. The assembly is completed by a coupling tube having external threads for threaded engagement with the cap and a suitable stem at its other end for connection to the lateral line. (Sinha-OEIS)
W77-12698

IRRIGATION TUBING.
Hancor, Inc., Findlay, Ohio. (Assignee).
W. I. Hoyle, and J. D. Schmunk.
U.S. Patent No 4,022,384, 6 p, 9 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 640, May 10, 1977.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Irrigation design, Application equipment, Flow, Flow rates.
Identifiers: Drip irrigation.

An irrigation tubing comprises an outer tubular member having an inside wall, an outside wall and outlet apertures. An inner tubular member fits inside the outer tubular member and has a repeating pattern of crests and roots. The crests engage the inside wall of the outer tubular member, and the roots form connected conduits defining a tortuous passageway which reduces the pressure of liquid. Apertures in the inner tubular member provide fluid communication between the inside of the inner tubular member and the passageway. The invention has the advantage of variable flow rates at a given location. The design and size of the tortuous path and not the sizes of the inlet or outlet aperture are used to govern the flow rate. The use of closely spaced paired outlet apertures fed by separate oppositely directed passageways may adjust the outlet flow rate by a factor of two and one aperture may be reserved in case the other one clogs. (Sinha-OEIS)
W77-12699

CENTER-PIVOT IRRIGATION SYSTEM.
Valmont Industries, Inc., Valley, Nebr. (Assignee).
R. B. Daugherty, and W. C. Eaton.
U.S. Patent No 3,902,668, 5 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 938, No 1, p 168, September 2, 1975.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation systems, *Irrigation efficiency, Control systems, Automatic control, Electrical equipment.

The invention relates to a center-pivot irrigation system for use with a water source connected to a central water supply point and an electrical conductor defining a path related to the configuration of the area to be irrigated. The system includes an elongated main water conduit communicating with the water source and projecting radially outward from the central point, the main water conduit being mounted on and extending between a series of propelled support towers located at spaced points along the main conduit and pivoted around the central point. A boom comprising an auxiliary water conduit is connected with the main water conduit, being supported on at least one boom sup-

port tower and connected to the end of the main water conduit opposite the central water point supply. A number of sprinkler heads are located at spaced points along the main water conduit and the auxiliary water conduit. Sensing means are field-coupled to the electrical conductor, and control means are coupled to the sensing means and to the boom support tower for guiding the boom support tower and the boom along the path defined by the electrical conductor to thereby determine the configuration of the irrigated area. (Sinha-OEIS)
W77-12709

OPTIMIZATION OF SUBUNIT DIMENSIONS FOR PRESSURIZED IRRIGATION SYSTEMS.
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
G. Oron, D. Karmeli, and W. R. Walker.
Paper No 76-2521. Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 11 p, 4 fig, 4 ref.

Descriptors: *Optimization, Irrigation, Irrigation design, *Irrigation systems, Pipelines, Piping systems, Model studies, Computer models, *Pipes.
Identifiers: *Pressurized irrigation systems, Drip irrigation, Trickle irrigation.

The sophistication in analyzing optimality in a pressurized irrigation system design has evolved from pipe sizing problems to complex evaluations of layout alternatives, field dimensions, energy input, and operational criteria. The nonlinear, mixed-integer model developed gave interesting results to the more general design questions, but its complexity precludes its use as a design tool for many design applications, particularly where certain assumptions on field layout have been made. Results given in this paper demonstrate two of the possible uses a model like this may find feasible. (Skogerboe-Colorado State)
W77-12710

PLANNING A LARGE IRRIGATION PROJECT.
Rainbow Mfg., Co., Fitzgerald, Ga.
Z. Mahamud.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 10 p, 8 fig, 1 tab.

Descriptors: Irrigation, Irrigation design, Irrigation engineering, *Irrigation systems, *Project feasibility, *Project planning, Projects.

A complete turnkey project of soil classification, agronomic evaluation with irrigation and drainage study was carried out. Economic analysis with various alternatives was computed. (Skogerboe-Colorado State)
W77-12711

OPERATION AND MAINTENANCE OF IRRIGATION AND DRAINAGE SYSTEMS: SECTION IV.—MAINTENANCE.
American Society of Civil Engineers, New York. Committee on Operation and Maintenance of Irrigation and Drainage Systems.
Journal of the Irrigation and Drainage Division, Proceedings of the ASCE, Vol 102, No IRI, p 1-107, March 1976. 30 fig, 3 tab, 43 ref.

Descriptors: *Irrigation operation and maintenance, Irrigation, Irrigation canals, Irrigation ditches, Irrigation effects, *Irrigation systems, Drainage effects, Drainage practices, *Drainage systems, *Drains, *Salinity.

The subject of maintenance is treated by a discussion of the factors essential to keeping the facilities of an irrigation and drainage system in good condition, the staff necessary to accomplish the work and that staff's responsibility, and common practices and procedures used for the maintenance

of structures and facilities pertinent to such systems. The irrigation systems referred to are those generally associated with the movement of water from its source to the user and which are prevalent in arid and semi-arid areas. The drainage systems are those in which seasonal removal of water is normally a necessity, due to possible water-logging of the soil, or the buildup of salts in it. The system involved may be an essential part of an irrigation system in an arid or semi-arid area or one of the larger and more extensive systems located in the semihumid or humid areas. (Skogerboe-Colorado State)
W77-12712

SIGNIFICANCE OF WATER QUALITY TO WATER RESOURCES.
Colorado River Board of California, Los Angeles. For primary bibliographic entry see Field 5G.
W77-12714

ENERGY ECONOMICS IN PIPE AND SYSTEM SELECTION.
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
J. Keller.
In: 1976 Annual Technical Conference Proceedings, Sprinkler Irrigation Association, Technology for a Changing World, February 22-24, 1976, Kansas City, Missouri, p 134-145. 4 fig, 2 tab, 6 ref.

Descriptors: Energy, *Irrigation design, Hydraulics, *Irrigation systems, Pipe flow, *Pipes, Irrigation efficiency, Hydraulic design.
Identifiers: Pipe irrigation, Irrigation systems selection.

A rational means for using economic factors as the basis for selection of pipe and irrigation system components is presented. A graphical method developed by Keller is also presented and can be used to speed the economic sizing of mainline pipes. (Skogerboe-Colorado State)
W77-12715

CRITICAL IRRIGATION MANAGEMENT DECISIONS.
Agricultural Technology Co., McCook, Nebr.
F. C. Corey.
In: 1976 Annual Technical Conference Proceedings, Sprinkler Irrigation Association, Technology for a Changing World, February 22-24, 1976, Kansas City, Missouri, p 146-162. 3 fig, 5 ref.

Descriptors: Sprinkler irrigation, Irrigation, Furrow irrigation, Flood irrigation, *Irrigation systems, Irrigation practices, *Crop production, *Irrigation efficiency, *Water management(Applied), Costs.

With increasing land development and the millions of acreage already under sprinkler and gravity irrigation it is to the farmers interest (economically) to have a good engineered irrigation system and see that it is managed and operated in the most efficient manner to obtain maximum yields at the least cost. This irrigation system includes planning, development, maintenance and management of the well, the pumping system, and the sprinkler or distribution system. This paper is limited to sprinkler irrigation and pertains to: (a) brief introduction to Ag Technology Co, (b) agricultural production, design and management problems observed by this company over the last five to ten years, (c) irrigation management techniques necessary to make critical irrigation decisions, and (d) any possible future trends and techniques necessary to management of resources at an optimum level. (Skogerboe-Colorado State)
W77-12716

OPTIMAL ON-FARM ALLOCATION OF IRRIGATION WATER.
Escuela Nacional de Agricultura, Chapingo (Mexico), Colegio de Postgraduados.
J. Trava, D. F. Heermann, and J. W. Labadie.
Paper No 76-2040, Presented at the Annual Meeting of the American Society of Agricultural Engineers, June 27-30, 1976, Lincoln, Nebraska, 14 p, 4 tab, 23 ref.

Descriptors: Model studies, Simulation analysis, *Irrigation water, Crop production, *Optimization, Systems analysis, *Water allocation, Water delivery.
Identifiers: *Irrigation scheduling.

The USDA-ARS Scheduling Program is a powerful tool to assist management in the efficient use of irrigation water on the farm. The Water Management Program incorporating an optimization technique provides a tool for scheduling irrigation within constraints of water and labor. The application of systems analysis in making operational real-time management decisions has far-reaching possibilities for further development. More complex objective functions and additional constraints will provide even more assistance to management. The application of the Dantzig-Wolfe decomposition principle to large-scale water management problems demonstrates a feasible way of using systems analysis for operational problems. (Skogerboe-Colorado State)
W77-12719

SOIL SALINITY TESTING IN THE FIELD.
For primary bibliographic entry see Field 7B.
W77-12720

VENTURI FLUMES FOR CIRCULAR CHANNELS.
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 8B.
W77-12721

INFORMATION STORAGE AND RETRIEVAL FOR EVALUATION OF IRRIGATION POTENTIAL.
Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 7C.
W77-12723

MANAGING SALINE WATER FOR IRRIGATION.
International Center for Arid and Semi-Arid Land Studies, Lubbock, Tex.
For primary bibliographic entry see Field 3C.
W77-12726

DEVELOPMENT AND EVALUATION OF EVAPOTRANSPIRATION MODELS FOR IRRIGATION SCHEDULING.
Agricultural Research Service, Kimberly Idaho. Snake River Conservation Research Center.
J. L. Wright, and M. E. Jensen.
Paper No. 76-2063, Presented at the 1976 Annual Meeting of the American Society of Agricultural Engineers, June 27-30, 1976, Lincoln, Nebraska, 11 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Evapotranspiration, *Crop production, Irrigation, *Micrometeorology, Idaho, Lysimeters, Soil water, Beans, *Model studies.
Identifiers: *Irrigation scheduling, Net radiation, Potential evapotranspiration.

Evapotranspiration (ET) from irrigated crops as a function of crop, soil and micrometeorological conditions has been studied for several years in the arid region of southern Idaho. Earlier results were used to develop relationships for estimating net radiation and potential ET as used in the

USDA-ARS Computerized Irrigation Scheduling Program. Estimates obtained with the earlier relationships are compared with recent measurements obtained with two sensitive weighing lysimeters. Procedures used in the development of crop curve relationships are presented for some of the crops studied to date. The performance of the scheduling program in predicting the depletion of soil water for two years of irrigated beans is presented to demonstrate the accuracy of the procedures. The importance of obtaining representative meteorological data for irrigation scheduling is discussed. (Skogerboe-Colorado State)
W77-12779

EVAPOTRANSPIRATION POTENTIAL UNDER TRICKLE IRRIGATION.
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
W. R. Walker, S. W. Smith, and L. Geohring.
Paper No. 76-2009, Presented at the 1976 Annual Meeting of the American Society of Agricultural Engineers, June 27-30, 1976, Lincoln, Nebraska, 22 p, 7 fig, 18 ref.

Descriptors: *Evapotranspiration, Irrigation, *Irrigation systems, *Scheduling, Irrigation efficiency, Lysimeters, Peaches, Orchards, Soil moisture, *Forecasting, *Methodology.
Identifiers: *Trickle irrigation, Drip irrigation, *Irrigation scheduling.

Predicting evapotranspiration under trickle irrigated systems has posed difficult problems in scheduling and design because of the lack of generally applicable information. A review of currently available methodology is given along with lysimeter studies to assess the state-of-the-art. Application of findings is made to a young peach orchard which is trickle irrigated by soil moisture sensors. (Skogerboe-Colorado State)
W77-12780

AUTOMATION OF AN OPEN-DITCH IRRIGATION CONVEYANCE SYSTEM UTILIZING TILE OUTLETS.
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 4A.
W77-12781

TOWARDS A GENERAL GUIDELINE OF IRRIGATION WATER CHARGING POLICY.
Universitaet Hohenheim (Landwirtschaftliche Hochschule) (West Germany). Dept. of Agricultural Economics.
W. Doppler.
Agricultural Administration, Vol. 4, No. 2, p 121-129, April, 1977, 4 ref.

Descriptors: *Water rates, *Water allocation(Policy), *Irrigation water, *Irrigation programs, *Administration, *Water demand, Water supply, Water users, Agriculture, Political aspects, Economics, Pricing, Water, Irrigation, Use rates, Prices, Income distribution, Rates, Costs.
Identifiers: Economic development.

The main objectives of collecting water charges in irrigation schemes are to cover costs, increase and control agricultural production, increase agricultural incomes, and reach targets of structural, growth, and social policies. Suitable criteria for determining water charges depend upon the priorities of political objectives. Cost pricing is most suitable where an irrigation authority's financial position is primarily important. Benefit pricing is advisable to boost agricultural production. Equilibrium pricing is appropriate in conditions of perfect competition to solve water allocation problems. Considerations affecting the choice of criteria are discussed. These include: the upper and lower limits of charges, distribution of risk, cost coverage, support for agricultural production,

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income distribution, imperfections in the water market, and practical application of pricing principles. Methods of calculating and levying water charges are discussed including direct, volumetric and indirect charging, flat rate, and combined flat rate and water price based on the benefits pricing principle. Appropriate measures for water charging are considered in relationship to the irrigation experience of farmers and a country's political objectives and stage of development. The combined flat rate and water price charging seems suitable for a variety of objectives discussed. (Ullery-Arizona)
W77-12826

TROPICAL AGRICULTURE: CROP DIVERSITY AND CROP YIELDS,
Hawaii Univ. at Manoa.
J. Chang.
Economic Geography, Vol. 53, No. 3, p 241-254, July 1977, 1 fig, 3 tab, 33 ref.

Descriptors: *Tropical regions, *Crop production, *Moisture deficit, Agriculture, Droughts, Africa, Legumes, Cereal crops, Radiation, Rainfall, Solar radiation, Evapotranspiration, Irrigation, Monsoons, Crops, Fertility, Photosynthesis, Fertilizers, Diversification.

The agriculture of tropical lands is examined. Crops grown in tropical regions, characteristics of these crops, and a comparison of crop yields are presented. The problem of moisture deficit as it relates to tropical regions is evaluated. Much of the rain falls in storms in most tropical countries, and from 10 to 15 percent of the rainy days with the heaviest storms contribute half of the annual rainfall. Consequently, runoff is high and the proportion of rainfall useful for plant growth is lower than in the temperate zone. On the other hand, potential evapotranspiration is very high as a result of the large percentage of solar radiation retained as net radiation. Water deficits, or the difference between the potential evapotranspiration and effective rainfall, are very great in many parts of the tropics. The use of irrigation in tropical regions is discussed. The application of modern technology to increasing crop yields is not as profitable in the tropics as in the temperate zone, largely because of the lower yield potential and lower efficiency of water and fertilizer use in producing organic matter. (Jamail-Arizona)
W77-12828

EFFECT OF DATE OF FINAL IRRIGATION ON YIELD AND YIELD COMPONENTS OF SUNFLOWERS IN A SEMIARID ENVIRONMENT,
Oregon State Univ., Corvallis. Dept. of Agricultural Chemistry.
C. L. Browne.
Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. 17, p 482-488, June, 1977, 4 fig, 3 tab, 12 ref.

Descriptors: *Irrigation effects, *Irrigation efficiency, *Crop production, *Crop response, Irrigation, Semiarid climates, Australia, Crops, Irrigation practices, Moisture stress, Seeds, Consumptive use, Soil moisture, Flowering.
Identifiers: *Sunflowers.

In the semi-arid areas of southwestern New South Wales, many sunflower crops receive no irrigation after flowering. In these dry climates, such premature termination of irrigation could be causing substantial yield losses. The effect of the date of final irrigation on yield and yield components of sunflowers was examined. In the first experiment, seed yield increased 19 percent when final irrigation was applied 22 days after mid-flowering, rather than at mid-flowering. In the second experiment, in which all treatments were irrigated at a high frequency, seed yield increased 30 percent and total oil yield 48 percent when final irrigation was applied 16 days after mid-flowering, rather than at mid-flowering. Both seed weight and seed

number were increased by the later irrigation. (Jamail-Arizona)
W77-12829

INFLUENCE OF SEED PRETREATMENTS ON SALT TOLERANCE OF COTTON DURING GERMINATION,
Agricultural Research Service, Riverside Calif. Salinity Lab.
For primary bibliographic entry see Field 3C.
W77-12831

SPRINKLER METHOD OF IRRIGATION FOR WHEAT CROP IN LIGHT SOILS OF RAJASTHAN,
Udaipur Univ. (India). ICAR Coordinated Scheme on Water Management and Salinity.
R. S. Ram, R. C. Jain, and K. C. Jain.
Annals of Arid Zone, Vol. 16, No. 1, p 85-94, March, 1977, 2 fig, 3 tab, 5 ref.

Descriptors: *Sprinkler irrigation, *Irrigation, *Irrigation efficiency, Irrigation systems, Irrigation design, Irrigation practices, Soil-water-plant relationships, Water loss, Rates of application, Wheat, Water pressure, Nozzles, Spatial distribution, Crop response, Crop production, Arid lands.
Identifiers: *Distribution efficiency, Uniformity coefficient.

Results are reported of an experiment to determine the optimum distribution efficiency (uniformity coefficient) in sprinkler irrigation for wheat. No effect upon uniformity coefficient was noted for variations in pattern (rectangular, square, or triangular). Uniformity coefficient was maximum for nozzle size 6.25mm (compared to 4.69mm), with sprinklers spaced at a grid of 12.2m X 12.2m (compared to 18.3m X 12.2m), and operated at an average pressure of 1.98 kg/sq cm (compared to 2.98 kg/sq cm). The effect of wind velocity on uniformity coefficient was also calculated. Average yield was determined and the combined effect of land and water upon yield was evaluated. (Ullery-Arizona)
W77-12840

REGULATION OF GRAIN YIELD BY PHOTOSYNTHESIS IN MAIZE SUBJECTED TO A WATER DEFICIENCY,
Department of Scientific and Industrial Research, Palmerston North (New Zealand). Plant Physiology Div.
H. G. McPherson, and J. S. Boyer.
Agronomy Journal, Vol. 69, No. 4, p 714-718, July-August, 1977, 6 fig, 1 tab, 30 ref.

Descriptors: *Photosynthesis, *Moisture deficit, *Crop production, *Translocation, Corn(Field), Crop response, Grains(Crops), Moisture uptake, Plant physiology, Droughts, Plant growth.
Identifiers: Leaf water potential.

Drought causes massive losses in the yield of crops, but the physiological mechanisms responsible for decreased yields are poorly understood. Experiments were conducted on maize plants to attempt to identify these mechanisms. The plants were subjected to a water deficiency during most of the grain filling period. They were grown in a controlled environment capable of providing yields comparable to the field. Grain yields, dry weights of shoots and roots, apparent photosynthesis, and leaf water potential were determined. The results are presented. A low leaf water potentials, the grain developed partly at the expense of photosynthate accumulated prior to the desiccation period. Since grain development is dependent entirely on translocation in maize, this indicated that translocation continued despite the cessation of apparent photosynthesis. Translocation is less inhibited than photosynthesis during drought, and the total photosynthetic accumulation for the growing season controls yield during a drought. (Jamail-Arizona)
W77-12841

WATER RELATIONS OF LETTUCE: I. INTERNAL PHYSICAL ASPECTS FOR TWO CULTIVARS,
Agricultural Univ., Wageningen, (Netherlands). Dept. of Horticulture.
For primary bibliographic entry see Field 2I.
W77-12844

NITROGEN NUTRITION OF RICE PLANTS MEASURED BY GROWTH AND NUTRIENT CONTENT IN POT EXPERIMENTS: 4. ROLE OF THE WATER REGIME,
Agricultural Univ., Wageningen (Netherlands). Instituut voor Biologisch en Scheikundig Onderzoek van Landbouwgewassen.
W. Dijkshoorn, and M. Ismunadj.
Neth J Agric Sci. Vol. No. 21(3), p 181-187, 1973.

Descriptors: *Nitrogen, Denitrification, Nutrients, *Rice, Measurement, *Growth rates, *Saturated soils, *Nitrates, Ammonium.

Available N in a flooded soil under rice was assessed by measuring the N the plants could extract from the soil. During flooding the supply of ammonium was not changed, while nitrate rapidly denitrified. Ammonium, applied to the dry soil, nitrified. When later the soil was flooded for wet rice growing, nitrate denitrified and the supply of N was roughly halved. A change in soil pH in an acid direction to pH 4.5 was sufficient to check nitrification and loss of N at pre-flood application of ammonium.—Copyright 1974, Biological Abstracts, Inc.
W77-12858

ACREAGE LIMITATION PROVISIONS OF RECLAMATION LAW,
For primary bibliographic entry see Field 6E.
W77-12902

THE PRODUCTIVITY, FODDER VALUE AND UTILIZATION OF NUTRIENTS BY ALFALFA IN IRRIGATION AND APPLICATION OF MACROELEMENTS AND MOLYBDENUM, (IN RUSSIAN),
Moskovskaya Sel'skokhozyaistvennaya Akademiya (USSR). Div. of Meadow Science.
N. G. Andreev, V. M. Maksimov, and I. V. Kobozov.
Izv Timiryazev S-Kh Akad 1, p 55-64, 1977.

Descriptors: *Nutrients, *Alfalfa, *Irrigation, *Molybdenum, *Fertilizers, Phosphorus, Potassium, Crop production, Nitrates.

In the steppe zone of the Ukraine, in the Kirovograd region (USSR), irrigation and application of Mo in the alfalfa stand stimulated complete use of fertilizers which in turn provided the economic use of irrigated and rain water. P and K fertilizers improved the nitrogenous nutrition of plants while the addition of NH_4NO_3 promoted fuller use of P and potash from soil and fertilizers. The alfalfa yield was highest (11396 fodder units and 2556 kg of crude protein/ha) when it was irrigated and fertilized with P100K160N240 and Mo.—Copyright 1977, Biological Abstracts, Inc.
W77-12994

NITROGEN AND IRRIGATION IN FORAGE CROP ROTATIONS, (IN GERMAN),
Martin Luther-Universitaet, Halle-Wittenberg (East Germany). Abt. Wissenschaftspublizistik.
J. Simon.
Wiss Z Martin-Luther-Univ Halle-Wittenberg Math-Naturwiss Reihe 25(3), p 53, 1976.

Descriptors: *Nitrogen, *Irrigation, *Forage crops, Crop production, *Rotations, Beans, Oats, Corn(Field), Fertilizers, Sugarbeets, Ryes, Wheat.
Identifiers: *Czechoslovakia.

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Control Of Water On The Surface—Group 4A

On light black soil-serozem in the beet-rye production area of central Czechoslovakia, the influence of various irrigation systems and N fertilizer doses was studied on the yields of some field crops in the rotation involving red clover, winter wheat field beans, forage rye, silo maize, forage beets, sugar beets and green oats. The effects of irrigation and fertilizer use were compared for crop yields, dry weight and feed value content. Irrigation in general was more important than N fertilization.—Copyright 1977, Biological Abstracts, Inc. W77-12996

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

AQUATIC NATURAL AREAS IN IDAHO, Idaho Univ., Moscow. Dept. of Biological Sciences. F. W. Rabe, and N. L. Savage. Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 726. Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Moscow, Completion Report, June 1977. 113 p, 3 fig, 17 tab, 79 ref, 4 append. OWRT A-046-IDA(1), 14-34-0001-7027/7028.

Descriptors: *Aquatic habitats, *Classification, Lakes, Wetlands, Streams, Water types, Aquatic populations, Aquatic invertebrates, Conservation, *Idaho, *Land classification, Water chemistry, Biota, Bogs, *Methodology. Identifiers: *Aquatic natural areas.

Project objectives included classification of surface water features, identification of potential aquatic natural areas, and the development of an objective methodology for selection on natural areas. A preliminary classification system for streams, lakes and wetlands was developed based primarily of observable, physical features. Water chemistry characteristics and aquatic biota as well as physical features were studies in 32 northern Idaho streams as a basis for stream classification by community characteristics. Over 200 sites, of which 74% were on Forest Service lands, were identified as potential natural areas by land management agencies throughout the state. A methodology for selection of aquatic natural areas was proposed assigning non-weighted points to 20 physical, chemical, and biological features for both aquatic and terrestrial components of the site. The purpose was to rank sites for priority selection primarily by diversity of natural features. A methodology for a baseline description of an aquatic natural area was proposed using as an example a bog lake in northern Idaho. W77-12269

THE PHILIP EQUATION: A FEASIBLE MODEL FOR INFILTRATION ESTIMATION ON SMALL RANGELAND WATERSHEDS, Utah State Univ., Logan. Coll. of Natural Resources. For primary bibliographic entry see Field 2G. W77-12274

WATER ARID AGRICULTURES: SALINITY AND WATERLOGGING IN THE NEAR-EAST REGION, Food and Agriculture Organization of the United Nations, Cairo (Egypt). Near East Regional Office. For primary bibliographic entry see Field 3C. W77-12291

NUTRIENT TRANSPORT IN SURFACE RUNOFF AND INTERFLOW FROM AN ASPEN-BIRCH FOREST, Agricultural Research Service, Morris, Minn. North Central Region. For primary bibliographic entry see Field 5B. W77-12306

CORRELATIONS BETWEEN RAIN AND RUNOFF AMOUNTS AND COMPOSITION IN EASTERN SOUTH DAKOTA, South Dakota State Univ., Brookings. Dept. of Plant Science. E. M. White, E. J. Williamson, and Q. Kingsley. Journal of Environmental Quality, Vol 6, No 3, p 251-254, July-September, 1977. 1 fig, 3 tab, 23 ref.

Descriptors: *Rainfall-runoff relationships, *Nutrient removal, *South Dakota, Rainfall, Runoff, Correlation analysis, Regression analysis, Soils, Moisture content, Nutrients, Farms, Crops, Vegetation, Watersheds(Basins), Agriculture. Identifiers: Nutrient losses, Plant cover.

A correlation between a synthesized rainfall-intensity factor and runoff from small plots with sparse cover was significant but explained less than half the variation in the data. Loss of PO4-P, NO3-N, NH4-N, and K in runoff was correlated significantly to the runoff amounts, and the regression explained about 50 to 75% of the variation in the data. The unexplained variation in the regressions probably is due to antecedent plot conditions such as the soil and the plant cover growth or decomposition stage. Time since an antecedent rain was not related significantly to runoff. Average runoff volumes and average losses of PO4-P and NO3-N per runoff event from different-sized cultivated areas for 2- to 5-year periods had a highly significant correlation. The regressions, based on runoff volume and not on watershed size, apparently could estimate PO4-P and NO3-N losses on other watersheds in eastern South Dakota. (Sims-ISWS) W77-12308

FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN: PART I - EFFECTS OF RAYSTOWN LAKE ON THE LOW-FLOW FREQUENCY CHARACTERISTICS OF THE JUNIATA AND LOWER SUSQUEHANNA RIVERS, PENNSYLVANIA, Geological Survey, Harrisburg, Pa. Water Resources Div. J. T. Armbruster. Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 981/AS. Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-12, April 1977. 35 p, 21 fig, 7 tab, 7 ref.

Descriptors: *Model studies, *Reservoir operation, *Low-flow frequency, *Flow characteristics, *Flood routing, Streamflow, Pennsylvania, Maryland, Pre-impoundment, Post-impoundment, Simulation analysis, Regulated flow, Evaluation. Identifiers: *Lake Raystown(Pa), *Susquehanna River basin, Reservoir mass-balance.

A flow-routing model was used to simulate 17 water years of daily streamflows at five sites. The sites were Mapleton Depot and Newport, Pennsylvania, on the Juniata River, and Harrisburg and Marietta, Pennsylvania, and Conowingo, Maryland, on the Susquehanna River. The purpose for the simulations was to determine the effects of a new reservoir, Raystown Lake, on the low-flow frequency characteristics of these sites. Raystown Lake is on Raystown Branch Juniata River, a tributary to the Juniata River. Output from a reservoir-regulation model of Raystown Lake was used as input to the flow-routing models. In addition, a reservoir-routing model was developed for the hydroelectric power dams on the lower Susquehanna River. Low-flow frequency curves, based on the post-Raystown Lake simulated flows, were compared to similar curves based on

pre-Raystown observed data. The comparison indicated that operation of the lake will cause estimated increases in the 7-day 10-year low flows ranging from 420 cfs at Mapleton Depot to 290 cfs at Marietta and Conowingo over the 7-day 10-year low flows for pre-Raystown conditions. Although inherent modeling errors exist in all of these simulated data, the overall quality of the simulated flows and the low-flow frequency curves is considered good. (Woodard-USGS) W77-12380

WATER RESOURCES OF THE SATUS CREEK BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON, Geological Survey, Salt Lake City, Utah. Water Resources Div.; and Geological Survey, Tacoma, Wash. Water Resources Div. M. J. Mundorff, R. D. MacNish, and D. R. Cline. Open-file Report 76-685, 1977. 102 p, 32 fig, 1 plate, 13 tab, 26 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater resources, *Indian Reservations, *Washington, Hydrologic data, Irrigation, Snowmelt, Streamflow, Groundwater recharge, Aquifer characteristics, Water quality, Hydrologic budget, Potential water supply. Identifiers: *Yakima Indian Reservation(Wash), *Satus Creek basin(Wash).

The Satus Creek basin lies on the east flank of the Cascade Range in south-central Washington. The basin is entirely within the Yakima Indian Reservation and is bordered and drained on the east by the Yakima River. Average annual precipitation ranges from about 35 inches in the western upland to less than 10 inches in the eastern lowland. This amounts to a yearly total of about 562,000 acre-feet, most of which falls in the upland. Much of the precipitation falls as snow, and the streamflow from the upland reflects this fact, having a high sustained runoff during the snowmelt months of April, May, and June. In 1973 about 176,000 acre-feet of water was carried by canals for irrigation of about 19,000 acres in the lowland; of this quantity, about 173,000 acre-feet was imported from the adjoining Toppenish Creek basin. This high application rate of about 9.25 acre-feet of water per acre is largely responsible for severe waterlogging problems in many parts of the lowland. Relieving artesian heads by pumping, combined with reduced application and improved drainage, could alleviate the waterlogging, and free water for use in the irrigation of presently nonirrigated parts of the basin. Young volcanic rocks (basalt) in the southwestern, upland part of the basin receive nearly 70,000 acre-feet a year in recharge from precipitation and, although much of this water is what sustains the high base flows of the streams draining the rocks, the remaining water offers potential for development as a high-altitude source for irrigation water. (Woodard-USGS) W77-12383

TEMPERATURE OF MISSOURI STREAMS, Geological Survey, Rolla, Mo. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12385

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1976, Geological Survey, Carson City, Nev. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12386

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1976, Geological Survey, University, Ala. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12387

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1976.
Geological Survey, Columbia, S.C. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12388

WATER RESOURCES DATA FOR KENTUCKY, WATER YEAR 1976.
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12389

FRESH-WATER RESOURCES IN THE SOUTHEASTERN PART OF THE TULAROSA BASIN.
Geological Survey, Austin, Tex. Water Resources Div.; and Geological Survey, Albuquerque, N. Mex. Water Resources Div.
S. Garza, and J. S. McLean.
New Mexico State Engineer, Santa Fe, Technical Report 40, 1977. 67 p, 22 fig, 10 tab, 36 ref.

Descriptors: *Water resources, *Groundwater resources, *Surface waters, *Water quality, *Water utilization, New Mexico, Aquifer characteristics, Withdrawal, Water wells, Drawdown, Water yield, Irrigation wells, Water supply, Available water, Freshwater, Impaired water quality, Streams.
Identifiers: *Rio Tularosa basin(N Mex), Otero County(N Mex).

Freshwater resources are evaluated for the southeastern part of the Tularosa basin in south-central New Mexico. Particular emphasis is placed on the quantity and quality of the slightly saline ground water used for irrigation; the use and availability of surface water and potable ground water is also discussed. The study area encompasses approximately 1,100 square miles, or less than one-fifth of the Tularosa basin, and includes most of the nonmilitary part of the basin in Otero County. Ground water used for irrigation in the large irrigated area near Tularosa contains dissolved solids in concentrations ranging between 1,000 and 4,000 mg/liter. More than 11,000 acre-feet of ground water was withdrawn from the alluvial-fill aquifer for irrigating about 3,600 acres in this area during 1969. Net ground water withdrawn for all purposes in the study area during 1955-69 was more than 140,000 acre-feet; the corresponding volume of dewatered sediments was about 1,600,000 acre-feet. Most of the surface water from the westward-flowing streams in the Sacramento Mountains is used for irrigation (2,300 acres in 1969) in both the mountain areas and the basin. The city of Alamogordo's original water supply was spring flow in Alamo Creek. Imported surface water plus supplemental ground water from the La Luz well field are now also used by the city. (Woodard-USGS)
W77-12392

HYDROLOGICAL STUDIES ON SOME RIVER CATCHMENTS IN GREATER LONDON.
Greater London Council, (England. Dept. of Public Health Engineering.
For primary bibliographic entry see Field 2E.
W77-12403

STORM WATER MANAGEMENT MODEL: LEVEL I - PRELIMINARY SCREENING PROCEDURES.
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W77-12476

URBAN RUNOFF CHARACTERISTICS: VOLUME I - ANALYTICAL STUDIES.
Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.

For primary bibliographic entry see Field 5B.
W77-12477

EFFECTS OF IRRIGATION SCHEDULING AND COORDINATED DELIVERY ON IRRIGATION AND DRAINAGE SYSTEMS.
Bureau of Reclamation, Denver, Colo. Lower Colorado Region.
For primary bibliographic entry see Field 3F.
W77-12504

WEED MANAGEMENT TOOL HERBIGATION FOR IRRIGATED CROPLAND.
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 3F.
W77-12515

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME IV. OVERLAND FLOW ON AREAS SUBJECT TO INFILTRATION LOSSES.
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W77-12547

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME V. A DIMENSIONLESS HYDROGRAPH FOR ESTIMATING STORM RUNOFF FROM URBAN AREAS.
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W77-12548

LOW-COST DATA ANALYSIS SYSTEMS FOR PROCESSING MULTISPECTRAL SCANNER DATA.
National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.
For primary bibliographic entry see Field 7B.
W77-12549

EFFECT OF MISESTIMATING HARMONICS IN PERIODIC HYDROLOGIC PARAMETERS.
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2E.
W77-12550

STREAM-CHANNEL RESPONSE TO FLOODS, WITH EXAMPLES FROM CENTRAL TEXAS.
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W77-12553

WATER-TABLE MANAGEMENT.
Soil Conservation Service, Fort Worth, Tex. R. D. Wenberg.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 7 p, 4 fig, 14 ref.

Descriptors: *Drainage, *Irrigation water, Humid areas, Subsurface drainage, *Subsurface irrigation, *Water table, *Water management(Applied).

Water-table management is a combination of drainage and irrigation for the humid section of the United States. Subsurface drainage is used to lower the water table in coarse-textured soils and yields are improved by subsurface irrigation. (Skogerboe-Colorado State)
W77-12580

DRAINAGE PRACTICE IN IMPERIAL VALLEY, CALIFORNIA.
Agricultural Research Service, Brawley, Calif. Imperial Valley Conservation Research Center.
L. F. Hermsmeider.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 20 p, 7 tab, 13 ref.

Descriptors: *California, Drainage, *Drainage practices, Salinity, Return flow, Crop production, *Irrigation water, Seepage, Water table, Water pollution.
Identifiers: *Imperial Valley(Calif).

Some of the unique equipment and procedures developed during the past 50 years that have provided both low cost and effective drainage in the Imperial Valley are described. In this valley, as in most irrigated areas, land drainage is essential to provide the salinity and water table control necessary for good crop production. At present and in the future, increasing salinity and limited quantity of irrigation water, restrictions on quantity and the amount of contaminants in outflow and seepage water, and the need to provide improved growing conditions are presenting new challenges for drainage design and construction. These challenges and possible solutions are discussed. (Skogerboe-Colorado State)
W77-12581

LAND USE AND WATER QUALITY IN THE FLATHEAD DRAINAGE.
Montana Univ., Flathead Lake. Biological Station.
For primary bibliographic entry see Field 5B.
W77-12582

KNIFE RIVER FLOOD HAZARD ANALYSES, MERCER COUNTY, NORTH DAKOTA.
Soil Conservation Service, Bismarck, N. Dak.
For primary bibliographic entry see Field 2E.
W77-12592

FLOOD PLAIN INFORMATION: RIO SAN JOSE, PUEBLO OF LAGUNA, NEW MEXICO.
Army Engineer District, Albuquerque, N. Mex.
Prepared for Pueblo of Laguna Council, NM, May 1975, 34 p, 5 fig, 40 plates, 6 tab.

Descriptors: *New Mexico, *Flood data, *Peak discharge, *Non-structural alternatives, *Planning, Floods, Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood peak, *Flood plains, Standard Project Flood, Flood protection, Flood plain zoning, Warning systems, Building codes, Land use, Indian reservations.
Identifiers: *Pueblo of Laguna(NM), *Rio San Jose(NM), Rio Gypsum(NM), Acoma Creek(NM), Encinal Creek(NM), Laguna Indian reservation, Intermediate regional flood.

The study area includes the portions of the Laguna Indian Reservation subject to flooding from the Rio San Jose, Rio Gypsum, Acoma Creek, and Encinal Creek. Developments in the flood plain consist of small communities, irrigated farm land, grazing land and a major railway line. Flood data from stream gages are fragmentary since no gages have operated continuously. Newspaper accounts and information from a railway company and the Bureau of Indian Affairs provided supplementary data. Flooding is caused by thunderstorms and may occur at any time of year, but will most likely occur during the summer. There are numerous natural and manmade obstructions to flood flow along the entire length of the Rio San Jose in the study area. The most serious known flood occurred in September 1909 when two dams failed. Recent flooding occurred in 1965, 1972, and 1973. Data are not presented on the magnitude of these floods. The maximum discharge for the Intermediate Regional Flood (IRF) in the study area is expected to be 21,100 cubic feet per second (cfs), while the maximum Standard Project Flood (SPF) discharge would be 64,000 cfs. Many bridges and culverts in the study area would be overtopped by both the SPF and IRF. Data interpretation aids are provided in the report, as well as descriptions of

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non-structural flood protection alternatives. (Nessa-NC)
W77-12593

FLOOD PLAIN INFORMATION: ONEIDA CREEK, NEW YORK.

Army Engineer District, Buffalo, N.Y.
Prepared for Eastern Oswego Basin Regional Water Resources Planning Board, July 1973. 34 p, 18 fig, 13 plates, 5 tab.

Descriptors: *New York, *Flood data, *Peak discharge, *Land use, Floods, Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood peak, *Flood plains, Standard Project Flood, Non-structural alternatives, Flood plain zoning, Planning, Control structures.

Identifiers: *Oneida Creek(NY), Intermediate Regional Flood.

The Oneida Creek study area extends from the creek's mouth at Oneida Lake to a distance 19.2 miles upstream. Five communities are situated in the study area, with the City of Oneida being the major population center. Outside of the residential and commercial areas, most of the flood plain land is agricultural. Flood data were obtained from a U.S. Geological Survey (USGS) gage, USGS topographic sheets and meteorological data. There is no a distinct flood season. Peak flow have been recorded throughout the first 8 months of the year. Snowmelt or heavy rains or both may cause flooding. The greatest recorded flood flow occurred on March 28, 1950, discharging 7,440 cubic feet per second (cfs) at Oneida. Another large flood occurred on June 22, 1972, and discharged 7,250 cfs. The Intermediate Regional flood (IRF) is expected to discharge 11,400 cfs at the gaging station, while the Standard Project Flood (SPF) would discharge 22,900 cfs at the same location. Fifteen of the 21 bridges in the area would be overtopped by the IRF, while 18 of the 21 would be overtopped by the SPF. Structural and non-structural flood control measures are described to aid local officials in the development of a flood plain management program. (Nessa-NC)
W77-12594

FLOOD PLAIN INFORMATION: COLORADO RIVER AND COUNTRY CLUB CREEK, AUSTIN, TEXAS.

Army Engineer District, Fort Worth, Tex.
Prepared for City of Austin, TX, February 1975, 38 p, 10 fig, 11 plates, 6 tab.

Descriptors: *Texas, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Flood protection, Land use, Planning, Control structures, Standard Project Flood.

Identifiers: Austin(TX), *Colorado River(TX), Country Club Creek(TX), Intermediate Regional Flood.

The study area involves about 7.6 miles of the Colorado River and 2.4 miles of Country Club Creek, a right bank tributary of the Colorado, in the vicinity of Austin, Texas. Flood plain land uses are educational, industrial, commercial, residential, and recreational. The main flood season is spring and fall and results from heavy rainfall, although flood producing rains can occur year round. Flood data were obtained from U.S. Geological Survey (USGS) stream gages on the Colorado maintained since 1898, historical records and newspaper files. No historical records exist for Country Club Creek. No outstanding floods have been experienced on the Colorado River at Austin since the construction of reservoirs upstream. The flood of June 15, 1935 discharged 481,000 cubic feet per second (cfs), but would

have discharged only 60,000 cfs if the reservoirs had existed. Given the mediating effects of the reservoir system, the Intermediate Regional Flood (IRF) is expected to discharge 170,000 cfs on the Colorado and 6,000 cfs on Country Club Creek, while the Standard Project Flood would discharge 440,000 cfs on the Colorado and 8,400 cfs on Country Club Creek. This study's data, coupled with information provided on flood plain management, should help control future flood plain development. (Nessa-NC)
W77-12595

FLOOD PLAIN INFORMATION: KIRKWOOD BRANCH AND DOVE CREEK, SOUTHLAKE, TEXAS.

Army Engineer District, Fort Worth, Tex.
Prepared for City of Southlake, Texas, March 1976, 33 p, 7 fig, 12 plates, 8 tab.

Descriptors: *Texas, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Flood protection, Land use, Planning, Control structures.

Identifiers: *Southlake(TX), *Westlake(TX), *Kirkwood Branch(TX), *Dove Creek(TX), *Higgins Branch(TX), Tarrant County(TX), Denton County(TX), 50-year flood, 100-year flood, 500-year flood.

The study area involves Kirkwood Branch, South Fork of Kirkwood Branch, Higgins Branch and Dove Creek in Tarrant and Denton Counties, Texas, including the cities of Southlake and Westlake. Although the flood plains are primarily rural with scattered residential and commercial sites, the proximity of the area to the Dallas-Fort Worth Metropolitan Area, and the Dallas-Fort Worth Airport will likely lead to development pressures. The main flood season is spring and fall and results from heavy rainfall. Flooding has occurred in other seasons. Flood data were obtained from topographic maps, precipitation records and field surveys. No stream gage or historical flood records exist for the area. Stream gage records from the Dallas-Fort Worth area were used as indicators of flooding potential. The Intermediate Regional Flood (IRF) at the mouth of the Kirkwood Branch is expected to discharge 8,800 cubic feet per second (cfs), while the 500-year flood will discharge 11,600 cfs. At the mouth of Dove Creek, the IRF will discharge 3,900 cfs, while the 500-year flood will discharge 5,100 cfs. The data contained in this study are intended for use in the development of appropriate structural and non-structural flood control measures. (Nessa-NC)
W77-12596

FLOOD PLAIN INFORMATION: CANEY CREEK, MONTGOMERY COUNTY, TEXAS.

Army Engineer District, Galveston, Tex.
Prepared for Montgomery County, TX, August 1974, 34 p, 8 fig, 16 plates, 6 tab.

Descriptors: *Texas, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Stream-flow forecasting, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Flood protection, Land use, Planning, Control structures, Standard Project Flood, Flood damage.

Identifiers: *Caney Creek(TX), Montgomery County(TX), Intermediate Regional Flood.

The study area encompasses about 45 miles of the flood plain of Caney Creek from its confluence with the East Fork of San Jacinto River at the northern head of Lake Houston, in Montgomery and Harris Counties, Texas. Some commercial, residential, and industrial developments occupy the flood plain. The Caney Creek watershed is directly

in the path of the rapidly expanding Houston metropolitan area. Flooding occurs year round, resulting from intense local thundershowers or tropical storms. Flood data were obtained from a U.S. Geological Survey (USGS) stream gage, newspaper files, and topographic maps. The worst flood of record, measured at the USGS gage, occurred on June 13, 1973, discharging 35,000 cubic feet per second (cfs) and cresting at 145 feet mean sea level (msl). This flood approximates the Intermediate Regional Flood (IRF). At the mouth of Caney Creek, the IRF would discharge 135,200 cfs. Eleven bridges and culverts would be overtopped by the IRF. The data contained in this study are intended for use in developing appropriate structural and non-structural flood control measures. Flood plain management techniques and planning strategies are presented as an aid in developing a realistic flood damage reduction program. (Nessa-NC)
W77-12597

FLOOD PLAIN INFORMATION: COLLINS RIVER, BARREN FORK, HICKORY AND CHARLES CREEKS, McMINNIE, TENNESSEE.

Army Engineer District, Nashville, Tenn.
Prepared for City of McMinnville, TN, May 1973, 44 p, 14 fig, 12 plates, 5 tab.

Descriptors: *Tennessee, *Flood data, *Peak discharge, *Non-structural alternatives, *Planning, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Standard Project Flood, Flood protection, Land use.

Identifiers: McMinnville(TN), *Collins River(TN), Barren Fork(TN), Hickory Creek(TN), Charles Creek(TN), Intermediate Regional Flood.

The study area includes the City of McMinnville, Tennessee and surrounding areas that are subject to flooding by the Collins River, Barren Fork, Hickory and Charles Creeks. The flood plains are primarily agricultural with some residential development. Flood data were obtained from U.S. Geological Survey (USGS) stream gages, newspaper files, historical records, aerial photographs and field studies. Data collected on adjacent streams provided supplementary insights. Major flooding occurs during late winter and early spring and results from heavy general rainfall. The worst flood of record on the Collins River near McMinnville occurred on March 23, 1929, cresting at 864.9 feet mean sea level (msl) and discharging 75,300 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood is expected to discharge 82,000 cfs and crest at 867.0 feet msl, while the Standard Project Flood will discharge 142,000 cfs and crest at 878.9 feet msl. Historic and future flood profiles are also provided for the other waterways in the study area. Several bridges create the principal obstructions to flood flows in the study area. The data contained in this study are intended for use in the development of non-structural flood control measures. Structural alternatives have been studied and ruled unrealistic. (Nessa-NC)
W77-12598

FLOOD PLAIN INFORMATION: BROOKINGS, BROOKINGS COUNTY, SOUTH DAKOTA, VOLUME II, SIX MILE CREEK.

Army Engineer District, Omaha, Nebr.
Prepared for South Dakota Water Resources Commission and the City of Brookings, December 1974, 32 p, 17 fig, 6 plates, 7 tab.

Descriptors: *Flood data, *Non-structural alternatives, *Peak discharge, *Planning, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak,

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

Flow duration, Stage-discharge relations, *Flood plains, Flood protection, Land use, Control structures, *South Dakota, Standard Project Flood. Identifiers: Brookings(SD), *Six Mile Creek(SD), Intermediate Regional Flood.

The study area involves the 48,500 acre (76 square miles) Six Mile Creek watershed basin, including the City of Brookings, South Dakota. Use of the flood plain is primarily for pasture land and some cash crops. Some residential and industrial developments are encroaching on the flood plain from Brookings. Flood data were obtained from a U.S. Geological Survey (USGS) crest-stage gage maintained since 1956, SCS topographic maps, aerial photographs and newspaper files. Flooding occurs year round and is caused by heavy rain, snow melt, or both. The worst flood of record occurred on April 8, 1969, cresting at approximately 9.08 stage-feet and discharging approximately 1,000 cubic feet per second (cfs). This flood was caused by the melting of very heavy snow cover and the stage reading was affected by ice or debris at the bridge. The Intermediate Regional Flood (IRF) is expected to discharge 7,660 cfs at the downstream study limits, while the Standard Project Flood (SPF) will discharge 18,500 cfs at the same location. Several bridges form the principal obstructions to flood flows. Records indicate that a flood of the SPF magnitude has not occurred since the area was settled, although the IRF may have been exceeded. The flood data in this study are intended for use in the development of structural and non-structural flood control measures. (Nessa-NC) W77-12599

FLOOD PLAIN INFORMATION: SOUTHWEST STREAM GROUP, STOCKTON, CALIFORNIA. Army Engineer District, Sacramento, Calif. Prepared for San Joaquin County, CA. December 1975, 55 p, 34 fig, 26 plates, 12 tab.

Descriptors: *California, *Flood data, *Peak discharge, *Planning, Floods, Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood peak, *Flood plain, Land use, Standard Project Flood. Identifiers: Stockton(CA), *San Joaquin River(CA), Mormon Channel(CA), Duck Creek(CA), Walker Slough(CA), French Camp Slough(CA), Intermediate Regional Flood.

The portion of Stockton and adjoining areas to the south covered by this report are subject to flooding from the San Joaquin River, Mormon Channel, Duck Creek, and Walker and French Camp Sloughs. With the exception of the San Joaquin River, the waterways under study are the termini of an extremely complex system of interconnected tributary, distributary, and anabranch channels. Developments on the flood plain are extensive, ranging from residential, commercial and industrial to agricultural. Flood data were obtained from U.S. Geological Survey (USGS) stream gages, topographic maps, and publications; Corps of Engineers flood control data and post flood reports; precipitation records; and numerous state and local sources. The main flood season is November through April, and results from heavy general rainfall. A secondary snowmelt flood season occurs from April through June. The largest and most damaging recent rainfloods occurred in December 1950 and December 1955, discharging 79,000 cubic feet per second (cfs) and 50,900 cfs respectively on the San Joaquin River near Vernalis. At the same location, the Intermediate Regional Flood is expected to discharge 120,000 cfs, while the Standard Project Flood would discharge 370,000 cfs. This report is intended to aid in developing appropriate structural and non-structural flood plain management strategies. (Nessa-NC) W77-12600

FLOOD PLAIN INFORMATION: WILLOW RIVER AND PAPERJACK CREEK, NEW RICHMOND, WISCONSIN. Army Engineer District, St. Paul, Minn. Prepared for New Richmond, Wisconsin, Common Council, June 1975, 48 p, 28 fig, 32 plates, 6 tab.

Descriptors: *Wisconsin, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Building codes, Zoning, Standard Project Flood. Identifiers: *Willow River(WI), *Paperjack Creek(WI), New Richmond(WI), Intermediate Regional Flood.

The study area includes the portions of New Richmond, Wisconsin that are subject to flooding from Willow River and Paperjack Creek. Flood plain land uses include agricultural, urban and rural residential, commercial, and considerable industrial development. Flood data were obtained from a U.S. Geological Survey (USGS) crest stage gage maintained from 1959 to 1968, high water marks established subsequent to major floods in 1965 and 1967, newspaper files and historical records. The major flood season occurs in March and April when snowmelt combines with spring rains. Although historical flood data are limited, it appears that the April 11, 1965 peak discharge of 6,400 cubic feet per second (cfs) with a crest of 978.7 feet mean sea level (msl) amounts to the worst known flood. At the same location, the Intermediate Regional Flood (IRF) is expected to crest at 980.2 feet msl, while the Standard Project Flood is expected to crest at 988.3 feet msl. The principal obstructions to flood flows are the 15 bridges and culverts that would be overtopped by the IRF. There are no permanent flood control structures in the area. The data contained in this report will aid in implementation of existing city and county zoning ordinances and building codes. (Nessa-NC) W77-12601

FLOOD PLAIN INFORMATION: WISCONSIN RIVER, COLUMBIA AND SAUK COUNTIES, WISCONSIN. Army Engineer District, St. Paul, Minn. Prepared for Sauk County Planning and Zoning, Conservation and Recreation Committee, and the Columbia County Board of Supervisors, June 1975, 24 p, 13 fig, 32 plates, 6 tab.

Descriptors: *Wisconsin, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Standard Project Flood, Flood protection, Land use, Planning, Levee. Identifiers: *Wisconsin River(WI), Wisconsin Dells(WI), Columbia County(WI), Sauk County(WI), Intermediate Regional Flood.

The study area extends 16.8 river miles from the north city limits of Wisconsin Dells, which is also the north county line of Sauk and Columbia Counties, to the north-south boundary between Sauk and Columbia Counties. Flood plain land uses within Wisconsin Dells are primarily residential, commercial, and light industrial. Agricultural uses predominate in the rural flood plain areas. Flood data were obtained from a U.S. Geological Survey (USGS) gage maintained since 1935, historical records, newspaper files, topographic maps and aerial photographs. The main flood season occurs in the spring, summer and fall and is caused by heavy general rainfall. Winter flooding does occur and snowmelt can contribute to flooding problems. The worst flood recorded at the USGS gage occurred on September 14, 1938, discharging 72,200 cubic feet per second (cfs) and cresting at 825.28

feet mean sea level (msl). At the same location, the Intermediate Regional Flood is expected to crest at 827.09 feet msl, while the Standard Project Flood will crest at 832.78 feet msl. Some structural and non-structural flood controls exist in the study area. The data contained in this report are intended for use in developing the necessary flood plain management program, including regulatory measures. (Nessa-NC) W77-12602

FLOOD PLAIN INFORMATION: DORCHESTER, WHITMAN, QUESSET, BLACK, BEAVER, POQUANTICUT, MULBERRY AND GOWARDS BROOKS, EASTON, MASSACHUSETTS. Army Engineer District, Waltham, Mass. April 1977, 66 p, 28 fig, 27 plates, 17 tab.

Descriptors: *Massachusetts, *Flood data, *Peak discharge, *Non-structural alternatives, *Land use, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Flood protection, Planning. Identifiers: Easton(MA), Dorchester Brook(MA), Whitman Brook(MA), Queset Brook(MA), Black Brook(MA), Beaver Brook(MA), Poquanticut Brook(MA), Mulberry Brook(MA), Gowards Brook(MA), 500-year flood, Intermediate Regional Flood(IRF).

The study area involves the portions of the Town of Easton, Massachusetts affected by flooding from Dorchester, Whitman, Queset, Black, Beaver, Poquanticut, Mulberry and Gowards Brooks. Easton is developing rapidly as a commuter suburb of Boston. Wetlands comprise much of the undeveloped land. Development would affect storm runoff since the town's large storage capacity would be markedly reduced. Flood data were obtained from a U.S. Geological Survey (USGS) gage just outside the study area on Dorchester Brook maintained since 1968, historical records, newspaper files, and topographic maps. Flooding occurs year round and results from heavy rainfall. The only known crest stage and discharge for a high intensity flood were recorded on March 17-18, 1968. The stage was 5.86 feet mean sea level (msl). This flood was considered to be a 50-year return frequency flood. Larger unmeasured floods have occurred. Data are tabulated at several locations along each brook regarding peak discharges expected from the Intermediate Regional Flood (IRF) and the 500-year flood, water surface elevations for these floods, and the impact of all dams and culverts on these flood flows. Easton has a flood plain zoning ordinance. This study provides the data necessary for development of other structural and nonstructural flood control measures. The study describes these flood control options. (Nessa-NC) W77-12603

FLOOD PLAIN INFORMATION: LITTLE ANDROSCOGGIN RIVER: AUBURN, POLAND, MECHANIC FALLS, AND MINOT, MAINE. Army Engineer District, Waltham, Mass. February 1974, 31 p, 22 fig, 20 plates, 6 tab.

Descriptors: *Maine, *Flood data, *Peak discharge, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Design flood, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Land use, Planning, Standard Project Flood. Identifiers: Auburn(ME), Poland(ME), *Mechanic Falls(ME), Minot(ME), *Little Androscoggin River(ME), Bog Brook(ME), Intermediate Regional Flood.

The study area includes the portions of Auburn, Poland, Minot, and Mechanic Falls, Maine, sub-

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ject to flooding by the Little Androscoggin River and its tributaries, especially Bog Brook in Mechanic Falls. Flood plain land uses in the urban areas are residential, commercial and industrial. Agricultural and woodland uses predominate elsewhere. Flood data were obtained from two U.S. Geological Survey (USGS) gages in Auburn, newspaper files, historical records, topographic maps and field surveys. The main flood season is spring, resulting from snowmelt and rainfall. Hurricanes and tropical storms can cause fall flooding. The worst flood of record as estimated at the downstream study limits occurred on March 20, 1936, cresting at approximately 231.76 feet mean sea level (msl), and discharging an estimated 16,800 cubic feet per second (cfs). At the same location the Intermediate Regional Flood (IRF) would crest at 137.80 feet msl and discharge 22,100 cfs, while the Standard Project Flood (SPF) would crest at 144.50 feet msl and discharge 28,500 cfs. Similar data are tabulated for numerous locations in the study area. This study is intended for use by communities in the study area for the development of flood plain management regulatory measures, as required by the Governor's 1968 Executive Order. (Nessa-NC)
W77-12604

FLOOD PLAIN INFORMATION: MILLERS RIVER AND NORTH BRANCH: WINCHENDON, MASSACHUSETTS.
Army Engineer District, Waltham, Mass.
December 1976, 35 p, 13 fig, 9 plates, 7 tab.

Descriptors: *Massachusetts, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Historic floods, Flood frequency, Flood peak, Flow duration, Stage-discharge relations, *Flood plains, Flood protection, Land use, Planning, Control structures.
Identifiers: Winchendon(MA), *Millers River(MA), *North Branch(MA), 500-year flood, Intermediate Regional Flood.

The study area includes the portions of Winchendon, Massachusetts subject to flooding from Millers River and North Branch. Developments in the flood plain are primarily residential and commercial, and have sustained damages in past floods. Flood data were obtained from a U.S. Geological Survey (USGS) gage located at the beginning of the study reach and maintained since 1916, newspaper files, historical records, topographic maps, and field surveys. Flooding occurs in the spring and fall, resulting from rainfall, snowmelt, or both. The worst flood of record, measured at the USGS gage, occurred on September 22, 1938, cresting at 848.2 feet mean sea level (msl) and discharging 8,500 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood (IRF) is expected to crest at 854.1 feet msl and discharge 5,400 cfs, while the 500-year flood is expected to crest at the same elevation as the IRF and to discharge 9,300 cfs. Flood elevations are tabulated for other locations on Millers River and North Branch. No historical records exist for North Branch. At Whitney Pond on North Branch, the IRF will discharge 1,400 cfs, and the 500-year flood will discharge 2,400 cfs. Alternative structural and non-structural flood control measures are described. (Nessa-NC)
W77-12605

FLOOD PLAIN INFORMATION: WEST RIVER AND UTLEY BROOK: WESTON-LONDONDERRY, VERMONT.
Army Engineer District, Waltham, Mass.
June 1977, 42 p, 18 fig, 20 plates, 7 tab.

Descriptors: *Vermont, *Flood data, *Peak discharge, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Stream flow forecasting, Flood forecasting, Flood frequency, Flood peak, Flow duration, Stage-

discharge relations, *Flood plains, Flood protection, Land use, Planning, Control structures.
Identifiers: Weston-Londonderry(VT), *West River(VT), Utley(VT), 500-year flood, Intermediate Regional Flood.

The study area includes the portions of Weston and Londonderry, Vermont subject to flooding from the West River and Utley Brook. Flood plain land uses are primarily residential and agricultural and have sustained heavy damages from past floods. Flood data were obtained from two U.S. Geological Survey (USGS) gages located downstream from the study area, newspaper files, historical documents, topographic maps, aerial photographs, and field surveys. The major flood seasons are the spring and fall and result from tropical storms, heavy rains, or snowmelt. The worst flood recorded at the oldest gage downstream from the study area occurred on November 3, 1927, and discharged 45,000 cubic feet per second (cfs). At the mouth of Utley Brook, the Intermediate Regional Flood (IRF) is expected to discharge 10,500 cfs, while the 500-year flood will discharge 18,800 cfs. On the West River, upstream from the Winhall River, the IRF discharge will be 26,200 cfs, while the 500-year flood discharge will be 46,800 cfs. Tabulations of peak discharges and flood elevations at various other locations are presented. The data presented in this study are intended for use in the development of appropriate structural or non-structural flood control measures. Flood control alternatives are described. (Nessa-NC)
W77-12606

ESTIMATING SEEPAGE LOSSES FROM CANAL SYSTEMS.
Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center.
R. V. Worstell.
Journal of the Irrigation and Drainage Division, Proceeding of ASCE, Vol. 102, No. IR1, p 137-147, March 1976. 5 fig, 3 tab, 22 ref.

Descriptors: *Seepage, Canal seepage, Irrigation districts, *Irrigation efficiency, Canals, Measurement, *Distribution systems, *Water users.
Identifiers: *Seepage loss estimates, Seepage measurement.

Seepage and operational losses from distribution systems are continuing problems for designers and managers of irrigation districts and for water users. The designer must provide sufficient capacity in the canals to allow for those losses, and the managers must divert extra water into parts of the system to assure ample flow to the lower reaches of all laterals. The water users must provide for ample storage to offset seepage losses. The managers also have to deal with more complex legal and technical problems that arise if seepage losses cause high water tables in fields adjacent to the canal. As demands increase on all the water supplies of the West, regional and state resource management agencies are looking critically at the large volumes of water diverted by agriculture, especially when these volumes are much larger than the amounts used in evapotranspiration. These agencies need guidelines for more accurately determining reasonable water diversions to irrigated agriculture. A simplified method that engineers and resource planners can use to estimate seepage losses from new or existing canal systems is presented. (Skogerboe-Colorado State)
W77-12608

DRAINAGE PROGRESS AND PROBLEMS ON THE COLUMBIA BASIN PROJECT.
Bureau of Reclamation, Othello, Wash.
For primary bibliographic entry see Field 8A.
W77-12618

POLLUTION PROBABILITY ESTIMATED BY SMALL STORM FREQUENCY.
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W77-12620

THE STATE OF NATURAL AND INTRODUCED TREES AND SHRUBS AFTER A PROLONGED DROUGHT IN THE BAYALA SLATINA AREA, (IN BULGARIAN).
Forest Research Inst., Sofia (Bulgaria).
K. D. Kostov.
Gorskostop Nauka 11(4), p 87-90, 1974.

Descriptors: Droughts, *Trees, *Shrubs, Leaves, *Drought tolerance, Forests, *Forest management.
Identifiers: *Bulgaria(Bayala Slatina).

The state of the leaves (green, yellow, withered) of natural and introduced trees and shrubs in the Experimental Forest of the Bayala Slatina Forest (Bulgaria) were studied in 1972 (*Quercus cerris*, *Q. pubescens*, *Q. pedunculiflora*, *Ulmus campestris*, *Crataegus monogyna*, *Pyrus communis*, *Rosa* sp., *Prunus spinosa*, *Q. rubra*, *Q. sessiliflora*, *Q. longipes*, *Q. robur*, *Catanea sativa*, *Betula verrucosa*, *Corylus avellana*, *Gleditsia triacanthos*, *Robinia pseudoacacia*, *Ailanthus altissima*, *Cotinus coggygia*, *Acer caespitose*, *A. pseudoplatanus*, *A. tataricum*, *Tilia grandifolia*, *T. parvifolia*, *T. argentea*, *Fraxinus oxycarpa*, *Syringa vulgaris*, *Ligustrum vulgare*, *Prunus mahaleb*, *Sophora japonica*, *Amorpha fruticosa*, *Euonymus europaea*, *Aesculus hippocastanum*). This year was marked by a prolonged drought caused by insufficient precipitation during the autumn and winter and by the irregular distribution of rain.—Copyright 1976, Biological Abstracts, Inc.
W77-12627

OPERATION AND MAINTENANCE OF IRRIGATION AND DRAINAGE SYSTEMS: SECTION IV.—MAINTENANCE.
American Society of Civil Engineers, New York. Committee on Operation and Maintenance of Irrigation and Drainage Systems.
For primary bibliographic entry see Field 3F.
W77-12712

CRITICAL IRRIGATION MANAGEMENT DECISIONS.
Agricultural Technology Co., McCook, Nebr.
For primary bibliographic entry see Field 3F.
W77-12716

FLOOD RISK MAP, CARMAN, MANITOBA.
Department of Mines, Resources and Environmental Management, Winnipeg (Manitoba). Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12770

AUTOMATION OF AN OPEN-DITCH IRRIGATION CONVEYANCE SYSTEM UTILIZING TILE OUTLETS.
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
L. J. Erie, and A. R. Dedrick.
Paper No. 76-2050, Presented at the 1976 Annual Meeting of the American Society of Agricultural Engineers, June 27-30, 1976, Lincoln, Nebraska, 14 p, 6 fig, 5 ref.

Descriptors: Irrigation, *Irrigation practices, Irrigation systems, Automation, Basins, *Tiles, *Tile drains, *Irrigation ditches.
Identifiers: Basin irrigation.

An irrigation system on a 28.4 ha (70 acre) field divided into seven dead-level basins, irrigated from a centrally-located concrete-lined canal, using

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modified cylinders on jack-gates and structures utilizing air pillows or bellows, was automated by use of pneumatic controls. A structure was designed that would contain items pertinent to automation, so that turning the water into the field and shutting it off would be automatically accomplished according to a predetermined time schedule. (Skogerboe-Colorado State)
W77-12781

STOCHASTIC MODELING OF HYDROLOGIC, INTERMITTENT DAILY PROCESSES,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2B.
W77-12796

THE UNSTEADY GROUNDWATER MOUND BELOW AN IRRIGATION DITCH OR LEAKY CANAL,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 2G.
W77-12801

MISSOURI RIVER MAIN STEM RESERVOIR REGULATION STUDIES.
Northern Great Plains Resources Program. Denver, Colo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 847, Price codes: A04 in paper copy, A01 in microfiche. Corps of Engineers, Omaha, Nebraska, Office of the Division Engineer, Missouri River Division. Denver, Colorado. Report NGPRP/CD-74/203, April 1974. 63 p, 30 fig, 30 plate.

Descriptors: *Montana, *North Dakota, *Regulation, *Reservoir operation, *Energy, *Hydroelectric power, *Irrigation water, *Missouri River, Water supply, Navigation, Recreation, Fisheries, Water quality, Computer models, Hydrology, Coal mines.
Identifiers: *Coal development, *Northern Great Plains.

A primary purpose of the reported studies was to explore the effects of contemplated coal development in Montana and North Dakota on the regulation of Fort Peck, Garrison, Oahe, Big Bend, Fort Randall, and Gavins Point reservoirs on the main stem of the Missouri River in respect to flood control, irrigation withdrawals, water quality needs, water supply requirements, navigation demands, hydroelectric power generation, fishery resources, and recreation. The studies were conducted for four conditions of coal development: no coal development, minimum coal development with average annual runoff depletion of 700,000 acre-feet above the main stem system, most likely coal development with depletion of 1,400,000 acre-feet and maximum coal development resulting in average depletion of 3,000,000 acre-feet. The studies showed that there is sufficient water to provide for coal development, but the navigation season may have to be shortened. Also, there would be a reduction in hydroelectric power generation depending on the amounts of water used for coal development. (Singh-ISWS)
W77-12819

AEROSPACE RESEARCH OF THE ENVIRONMENT. GEOBOTANY, SOIL SCIENCE, AND HYDROLOGY.
For primary bibliographic entry see Field 7B.
W77-12820

THE RESPONSE OF FLOODS AND SEDIMENT YIELDS TO CLIMATIC VARIATION AND LAND USE IN THE UPPER MISSISSIPPI VALLEY,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 2E.
W77-12822

U.S.S.R.: GOLODNAYA (HUNGRY) STEPPE, (CASE STUDY OF DESERTIFICATION).
Ministry of Reclamation and Water Management, Moscow (USSR).
For primary bibliographic entry see Field 3C.
W77-12825

HYDROLOGY OF THE SAHARA,
United Nations Educational, Scientific and Cultural Organization, Cairo (Egypt). Regional Office of Science and Technology for the Arab States.
For primary bibliographic entry see Field 6D.
W77-12834

THE HYDRAULIC RESISTANCE OF SUBSURFACE DRAINS AS INFLUENCED BY CERTAIN FILTER MATERIALS,
Ministry of Agriculture, Cairo (Egypt). Soil and Water Research Inst.
B. G. Bishay, and M. Safwat Youssef.
Agricultural Research Review (Cairo), Vol. 54, No. 4, p 55-61, April, 1976, 6 fig, 8 ref.

Descriptors: *Subsurface drains, *Filters, *Drains, *Soil water movement, *Hydraulic conductivity, Drainage, Permeability, Hydrology, Pervious soil, Filtration, Drainage systems.
Identifiers: Hydraulic resistance.

A study was conducted to determine whether the use of filters in soils of low and high permeability produces any significant difference in hydraulic resistance. Experiments were conducted using glass fibers and glass spheres as filters for subsurface drains. Glass fiber filter material greatly increased the hydraulic resistances of the drain. The glass spheres, which can be considered working as a homogeneous gravel filter, decreased the hydraulic resistances of the drain. The grainiform filter material showed better results on lowering the resistance in both types of soil used in the study. The filter made of fiber material caused an increase in the resistance, even more than in the drains without any filter. (Jamail-Arizona)
W77-12835

ENERGY AND THE COLORADO RIVER,
Utah State Univ., Logan. Dept. of Economics.
For primary bibliographic entry see Field 6D.
W77-12836

RESERVOIR MANAGEMENT AND THE WATER SCARCITY ISSUE IN THE UPPER COLORADO RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
R. G. Cummings, and J. W. McFarland.
Natural Resources Journal, Vol. 17, No. 1, p 81-96, January, 1977, 4 fig, 2 tab, 24 ref, append.

Descriptors: *Colorado River Basin, *Reservoir operation, *Colorado River, *Water storage, *Water policy, Reservoirs, Water rights, Water law, Colorado River Compact, Colorado, Wyoming, Utah, New Mexico, Water supply, Water utilization, Water demand, Model studies, Mathematical models, Water allocation(Policy), Water resources development.

An investigation was conducted to find optimum levels of water use commitments in the Upper Basin of the Colorado River within a context that allows for the evaluation of alternative estimates of flow-regimes in the Colorado River, and storage as it relates to these commitments. A framework for evaluating water allocation policies is outlined. The analytical model used is based on several assumptions as to the physical, political, institutional and socio-economic structure of the basin. The results are presented and the implications for policy and further research discussed. Studies concerning the ramifications of basinwide management of water must begin soon if they are to include the potential for the conjunctive manage-

ment of surface and groundwaters; discussions concerning flow augmentation alternatives must move into the evaluative stage in order that feasible alternatives may be included in discussions as to options available in the Upper Colorado region. (Jamail-Arizona)
W77-12839

THE NEED FOR A REFORM OF WATER USE LAW IN ILLINOIS,
Illinois State Office of the Attorney General, Springfield.
For primary bibliographic entry see Field 6E.
W77-12884

RECLAMATION LAW IN LITIGATION: ACREAGE AND RESIDENCY LIMITATIONS ON PRIVATE LANES,
For primary bibliographic entry see Field 6E.
W77-12889

ACREAGE LIMITATION PROVISIONS OF RECLAMATION LAW.
For primary bibliographic entry see Field 6E.
W77-12902

4B. Groundwater Management

A LABORATORY STUDY OF WASTE INJECTION INTO A GHYBENHERZBERG GROUNDWATER SYSTEM UNDER DYNAMIC CONDITIONS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 8B.
W77-12267

RESOURCE USE EFFICIENCY OF IRRIGATED FARMS IN BORUNDA TUBE-WELL COMMAND AREA, RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 3F.
W77-12279

EFFECT OF A SALINE AND ALKALINE GROUND WATER ON SOIL GENESIS IN SEMIARID SOUTHERN IRAN,
Pahlavi Univ., Shiraz (Iran). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-12280

RESEARCH ON EFFICIENT WATER USE,
Indian Agricultural Research Inst., New Delhi. Nuclear Research Lab.
For primary bibliographic entry see Field 2G.
W77-12282

VERTICAL DRAINAGE IN FIELD CORES,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-12304

TWO NEW METHODS FOR OBTAINING WATER SAMPLES FROM SHALLOW AQUIFERS AND LITTORAL SEDIMENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.; and Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 7B.
W77-12310

HYDROCHEMICAL ZONALITY OF GROUNDWATERS IN THE ARID ZONES OF THE USSR,
Akademiya Nauk SSSR, Moscow. Interagency Geophysical Committee.
For primary bibliographic entry see Field 2K.

W77-12311

THE GROUNDWATER RESOURCES OF URUGUAY,Israel National Oil Co., Ltd., Tel Aviv.
Y. Gilboa.

Hydrological Sciences Bulletin, Vol 22, No 1, p 115-126, March 1977. 3 fig, 2 tab, 11 ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Groundwater recharge, *Aquifers, *South America, Water utilization, Hydrogeology, Model studies, Water wells, Saline water intrusion, Coasts, Alluvial aquifers, Precipitation (Atmospheric), Infiltration, Storage capacity, Foreign research, Foreign countries.

Identifiers: *Uruguay, Well yields.

The major aquifers of Uruguay are the Tacuarembó aquifer in the northwest, the Quaternary aquifer of the Laguna Merin basin in the east, and the Quaternary aquifer or Libertad in the south. The water quality is good in all three aquifers. The Tacuarembó aquifer enjoys several advantages: large stored volumes of water, the possibility to increase replenishment by the intensification of water extraction, and great instantaneous-sometimes artesian-yields (up to 1000 cu m/h). Large amounts of water are replenishing the largest Quaternary aquifer, Laguna Merin, which also enjoys a huge operational storage capacity. The Quaternary aquifer of Libertad is characterized by acceptable instantaneous yields and is recharged by considerable amounts. The major advantage of the Quaternary aquifer of Libertad is its closeness to centers of consumption. Except for the Libertad section, safe yields were surpassed in most of the coastal areas, endangering the aquifers by seawater encroachment. The local aquifers will continue to supply small consumers. The nearby large aquifer of Libertad might replace deteriorating surface water in the case of rapid industrialization in urban water supply systems. The two large, untapped aquifers—the Tacuarembó sandstone and the Quaternary alluvium of Laguna Merin—are potential resources for intensive irrigation, complementing the consumption needs met only partially by rainfall. (Visocky-ISWS)

W77-12312

WATER-LEVEL RECORDS FOR THE LOWER ARKANSAS RIVER VALLEY OF COLORADO, 1973-77,

Geological Survey, Denver, Colo. Water Resources Div.

For primary bibliographic entry see Field 7C.

W77-12370

WATER-LEVEL RECORDS FOR ADAMS, LARIMER, LOGAN, MORGAN, SEDGWICK, WASHINGTON, AND WELD COUNTIES, COLORADO, 1973-77,

Geological Survey, Denver, Colo. Water Resources Div.

For primary bibliographic entry see Field 7C.

W77-12373

AVAILABILITY OF WATER IN THE FLORIDAN AQUIFER IN SOUTHERN DUVAL AND NORTHERN CLAY AND ST. JOHNS COUNTIES, FLORIDA,Geological Survey, Tallahassee, Fla. Water Resources Div.
R. W. Fairchild.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 556/AS. Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 76-98, April 1977. 53 p, 20 fig, 4 tab, 20 ref.

Descriptors: *Groundwater: resources, *Aquifer characteristics, *Water wells, *Water yield, *Water quality, Chemical analysis, Florida,

Hydrologic data, Withdrawal, Groundwater recharge, Water level fluctuations, Confined water, Permeability, Potentiometric level, Specific capacity, Storage coefficient, Transmissivity. Identifiers: *Floridan aquifer, Duval County, Clay County, St. Johns County.

The Floridan aquifer within the area of investigation consists of 1,100 to 1,800 feet of soft, porous limestone interbedded with hard, dense limestone and dolomite overlain by several hundred feet of confining beds. From late 1948 to May 1972, water levels in wells tapping the Floridan aquifer declined as much as 14 feet in northern Clay and St. Johns Counties and more than 20 feet at Jacksonville in Duval County, Florida. These trends will probably continue as withdrawals from the aquifer increase. Water-level depressions exist at Green Cove Springs and Jacksonville because of natural discharge and large scale withdrawals. Withdrawals from wells could result in well interference unless the wells are spaced at least 1,000 ft apart. Two- to four-inch diameter wells drilled 100 ft or less into the aquifer yield 50 to 250 gal/min. Larger and deeper wells yield 1,000 gal/min or more. Hardness of water is generally less than 10 mg/liter. Quality of water from wells sampled over a span of 10 to 30 years has not changed noticeably. Principal recharge to the Floridan occurs southwest of the area in a lake region where rainfall percolates directly into the aquifer. (Woodard-USGS)

W77-12374

HOT SPRINGS OF THE CENTRAL SIERRA NEVADA, CALIFORNIA,

Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 2K.

W77-12375

GROUND-WATER DISCHARGE FROM THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1976,

Geological Survey, San Antonio, Tex. Water Resources Div.

For primary bibliographic entry see Field 2F.

W77-12376

STORAGE OF TREATED SEWAGE EFFLUENT AND STORM WATER IN A SALINE AQUIFER, PINELLAS PENINSULA, FLORIDA,

Geological Survey, Tampa, Fla. Water Resources Div.

For primary bibliographic entry see Field 5E.

W77-12377

ARTIFICIAL RECHARGE EXPERIMENTS ON THE SHIP CREEK ALLUVIAL FAN, ANCHORAGE, ALASKA,

Geological Survey, Anchorage, Alaska, Water Resources Div.

G. S. Anderson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 623. Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 77-38, June 1977. 39 p, 19 fig, 1 plate, 1 tab, 9 ref.

Descriptors: *Artificial recharge, *Water spreading, *Diversion, *Aquifer characteristics, *Alaska, Water supply, Water table, Water wells, Water level fluctuations, Withdrawal, Water storage, Water management (Applied). Identifiers: *Anchorage (Alaska).

During the summers of 1973 and 1974, water from Ship Creek, Alaska, was diverted at an average rate of approximately 6 cfs (cubic feet per second) to an 11-acre recharge basin. Maximum sustained unit recharge for the basin was approximately 1.4 feet per day. During 1975 a second basin of 8 acres was also used for recharge, and the total diversion rate was increased to as much as 30 cfs. The

second basin was never completely filled, but the unit recharge rate was at least four times as great as that in the first basin. During 1973 and 1974, when only one recharge basin was in operation, a maximum rise of 18 feet was observed in the ground-water table near the basin. In 1975, when both basins were being used, the maximum rise was 30 feet in the same area. During 1973 and 1974, the water-level rise was 12 and 8 feet in the unconfined and confined systems, respectively, at a point 4,400 feet downgradient from the basins; in 1975 the rise at the same point was 31 and 16 feet, respectively. The potentiometric rise that was achieved in the confined aquifer during summer operation of the recharge basins was quickly dissipated when diversion stopped and the basins drained. Thus the benefits of recharge would not persist into late winter, the critical period for water availability in Anchorage, unless diversion to the basins could be continued until January or February. (Woodard-USGS)

W77-12378

THEORETICAL DRAWDOWN DUE TO SIMULATED PUMPAGE FROM THE OHIO RIVER ALLUVIAL AQUIFER NEAR SILOAM, KENTUCKY,Geological Survey, Louisville, Ky. Water Resources Div.
J. M. Kernodle.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 621. Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-24, April 1977. 39 p, 15 fig, 2 tab, 19 ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Pumping, *Drawdown, *Simulation analysis, Alluvial aquifers, Groundwater recharge, Well spacing, Ohio River, Kentucky.

Theoretical drawdown due to simulated pumpage was determined for a site near Siloam, Kentucky by using a digital ground-water-flow model. The maximum sustained yield of water from the single well was shown to be less than 900 gallons per minute, and, for a simulated pumping rate of 450 gallons per minute from each of several wells, the optimum placement for either minimum water-level drawdown or minimum spacing of multiple wells was found to be in a line parallel to and at a distance of about 370 to 600 feet from the Ohio River. An analytical method was used to verify the optimum placement of wells determined by the digital model. (Woodard-USGS)

W77-12379

DERIVATION OF EQUATIONS DESCRIBING SOLUTE TRANSPORT IN GROUND WATER,

Geological Survey, Denver, Colo. Water Resources Div.

For primary bibliographic entry see Field 5B.

W77-12381

GROUND-WATER QUALITY NEAR A SEWAGE-SLUDGE RECYCLING SITE AND A LANDFILL NEAR DENVER, COLORADO,

Geological Survey, Lakewood, Colo. Water Resources Div.

For primary bibliographic entry see Field 5B.

W77-12382

WATER RESOURCES OF THE SATU CREEK BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON,

Geological Survey, Salt Lake City, Utah. Water Resources Div.; and Geological Survey, Tacoma, Wash. Water Resources Div.

For primary bibliographic entry see Field 4A.

W77-12383

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

TEST-WELL DRILLING IN THE UPPER SATUS CREEK BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON.
Geological Survey, Tacoma, Wash. Water Resources Div.
H. E. Pearson.
Open-File Report 77-455, 1977. 14 p, 3 fig, 4 tab, 5 ref.

Descriptors: *Test wells, *Basalts, *Aquifer characteristics, *Water yield, *Water quality, Indian reservations, Washington, Well data, Pumping, Drawdown, Groundwater recharge, Hydrogeology, Drillers logs.
Identifiers: *Upper Satus Creek basin (Wash.), *Yakima Indian Reservation.

Two test wells were drilled in the upper Satus Creek basin of the Yakima Indian Reservation, Washington, using the air-rotary method. At site 1 the well penetrated a young basalt and 175 feet of the Yakima Basalt, and at site 2 the well penetrated the young basalt. The well at site 1 was drilled to a depth of 350 feet. Tests for drawdown and yield indicated a specific capacity of about 11 gallons per minute per foot of drawdown. The potential yield of this well may be about 1,000 gallons per minute. The well at site 2 was drilled to a depth of 500 feet. Only a small quantity of water was encountered and no test for yield was made. Data from these wells, including chemical analysis of the water from the well at site 1, will provide information useful in the development and management of the ground-water resources in this part of the Yakima Indian Reservation. (Woodard-USGS) W77-12384

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1976.
Geological Survey, Carson City, Nev. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12386

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1976.
Geological Survey, University, Ala. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12387

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1976.
Geological Survey, Columbia, S.C. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12388

WATER RESOURCES DATA FOR KENTUCKY, WATER YEAR 1976.
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12389

HYDROGEOLOGIC DATA FROM INVESTIGATION OF WATER RESOURCES OF THE SOUTH FORK, SUFFOLK COUNTY, NEW YORK.
Geological Survey, Mineola, N.Y. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12390

SIMULATION PROCEDURE FOR MODELING TRANSIENT WATER-TABLE AND ARTESIAN STRESS AND RESPONSE.
Geological Survey, Little Rock, Ark. Water Resources Div.; and Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-12391

FRESH-WATER RESOURCES IN THE SOUTHEASTERN PART OF THE TULAROSA BASIN.
Geological Survey, Austin, Tex. Water Resources Div.; and Geological Survey, Albuquerque, N. Mex. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-12392

GROUNDWATER LEVELS IN NEBRASKA, 1976.
Geological Survey, Lincoln, Nebr. Water Resources Div.; and Nebraska Univ., Lincoln. Conservation and Survey Div.
M. J. Ellis, and D. T. Pederson.
Nebraska Water Survey, Lincoln, Paper No 44, June 1977. 96 p, 23 ref.

Descriptors: *Nebraska, *Groundwater resources, *Observation wells, *Water level fluctuations, *Hydrographs, Maps, Aquifers, Withdrawal, Water utilization, Groundwater recharge, Surface waters, Diversion, Irrigation, Water resources development, Data collections, Groundwater availability.

The average water levels in the fall of 1976 were lower than those in the fall of 1975 in 91 of Nebraska's 93 counties. Declines averaged less than 1 ft in 49 counties and more than 1 ft in 42 counties. In two counties, the average water levels rose less than 1 ft. The greatest declines occurred in Chase, Fillmore, and Perkins Counties where the average water-level change was more than 3 ft. In 54 counties, average water-level declines were greater between fall 1975 and fall 1976 than between fall 1974 and fall 1975. A comparison of fall 1976 water levels with estimated predevelopment water levels made it possible to delineate eight major areas where water-resources development has resulted in significant declines or rises in groundwater levels. Large-scale use of groundwater for irrigation has caused significant water-level declines in the Big Blue River basin, Platte River valley, Mira Valley, O'Neill, Imperial, and Alliance areas. Significant water-level rises have occurred in the Tri-County and Farwell areas due to infiltration of surface water diverted for irrigation. (Woodard-USGS) W77-12393

AN EMPIRICAL METHOD FOR SIMULATION OF WATER TABLES BY DIGITAL COMPUTERS.
Nevada Univ., Reno. Water Resources Center.
For primary bibliographic entry see Field 2F.
W77-12546

ENERGY (HOT WATER) STORAGE IN GROUNDWATER AQUIFERS.
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
L. L. Ebeling, and D. L. Reddell.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 27 p, 7 fig, 1 tab, 26 ref.

Descriptors: *Groundwater, Model studies, *Aquifers, Management, Energy conversion, *Energy, Texas.
Identifiers: Hot water, Hot water storage.

A concept of storing hot water produced by solar collectors during the summer in groundwater aquifers is presented. The hot water would be pumped to the surface and used for space heating during the winter. The quantity of hot water capable of being produced at various areas in Texas and the aquifer availability for hot water storage is discussed. A numerical model to evaluate heat and mass transfer in the aquifer is developed. (Skogerboe-Colorado State) W77-12625

UNDERGROUND RESERVOIRS TO CONTROL THE WATER CYCLE.
Food and Agricultural Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 2F.
W77-12667

TWO-PHASE, TWO-DIMENSIONAL SIMULATION OF A GEOTHERMAL RESERVOIR.
Chevron Oil Field Research Co., La Habra, Calif.
For primary bibliographic entry see Field 2F.
W77-12674

DIGITAL MONITORS FOR OHIO'S WELLS.
Ground Water Age, Vol 11, No 11, p 19, p 30, July, 1977.

Descriptors: *Groundwater, *Monitoring, *Water level fluctuation, *Instrumentation, Gages, Digital computers, *Ohio.

Since 1946, Ohio's ground water resources have been measured by graphic type monitors strategically located throughout the state. The Ohio Dept. of Natural Resources, in cooperation with the U.S. Geological Survey, is now in the process of replacing many of these gauges with computerized monitors to more efficiently record ground water levels. The new digital monitors measure water level fluctuations once an hour by punching the measurement on a tape contained within the device. Hydrologists from the Department's water inventory section remove the tapes every two to three months. The information is then processed by a computer which charts and graphs daily water levels. Of the state's 122 ground water monitoring stations, 43 now have the digital monitors and an additional 30 are to be converted by 1978. Several graphic type recorders will not be replaced due to the need for continuous water level measurements at certain locations; severe water level fluctuations, for example, can be caused by seismic or climatological phenomena and may occur too quickly to be recorded by the once-per-month sampling of a digital monitor. (Eberle-NWWA) W77-12675

COMPOSITE WELL SYSTEMS.
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 8B.
W77-12678

INSTITUTIONAL AND ENVIRONMENTAL ASPECTS OF GEOTHERMAL ENERGY DEVELOPMENT.
Jet Propulsion Lab., Pasadena, Calif.
For primary bibliographic entry see Field 6G.
W77-12679

HOT DRY ROCK: WIDESPREAD BUT INVISIBLE.
Los Alamos Scientific Lab., N. Mex.
For primary bibliographic entry see Field 8E.
W77-12681

THE PRODUCTION OF WATER FROM GEOTHERMAL RESERVOIRS: SOME ECONOMIC CONSIDERATIONS.
California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 3A.
W77-12682

CYCLICAL ENERGY TRANSFER METHOD AND APPARATUS.
Cyclical Energy Transfer Method and Apparatus.
For primary bibliographic entry see Field 2F.
W77-12697

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Effects On Water Of Man's Non-Water Activities—Group 4C

GROUNDWATER OF VOJVODINA, ITS QUALITY AND APPLICABILITY FOR IRRIGATION

Novi Sad Univ. (Yugoslavia). Faculty of Agriculture.
For primary bibliographic entry see Field 5B.
W77-12728

CALCULATION AND PREDICTION OF THE SALT REGIME OF LOWLAND SOILS UNDER INFLUENCE OF GROUNDWATER SALINIZATION

Institut za Vodoprivredu Jaroslav Cerni, Belgrad (Yugoslavia).
For primary bibliographic entry see Field 2G.
W77-12729

GEOHERMAL INVESTIGATIONS IN IDAHO: PART 7, GEOCHEMISTRY AND GEOLOGIC SETTING OF THE THERMAL WATERS OF THE CAMAS PRAIRIE AREA

Idaho Dept. of Water Resources, Boise.
J. C. Mitchell.
Water Information Bulletin No. 30, September, 1976. 44 p, 12 fig, 2 tab, 82 ref, append.

Descriptors: *Geothermal studies, *Thermal waters, *Geochemistry, Thermal power, Heat flow, Trace elements, Thermal springs, Fluorides, On-site investigations, *Idaho.
Identifiers: *Camas Prairie Area(Idaho), Geothermal gradient, Geothermal thermometers.

Reconnaissance geochemical sampling of geothermal waters within Idaho has given indications that the Camas Prairie basin may have potential for geothermal energy utilization. The thermal waters of this east-west trending intermontaine basin are characteristically fluoride-rich, low in dissolved solids, widespread in occurrence, and closely associated with Cretaceous granitic rocks underlying and along the margins of the Prairie. They are probably meteoric origin, circulating to shallow depths along fractures and fissures and discharging upward into sediments of the Prairie. Maximum temperatures encountered in drilling to 900-1500 m are probably only about 100 degrees C. A prominent exception is the Magic Hot Springs area; waters here are chemically dissimilar to those of the surrounding area, are possibly circulating to a depth as great as 2500 m and appear to be ascending from an aquifer or reservoir with temperatures from 140 to 200 degrees C (sufficient heat for many industrial processes, including power generation). Further study is recommended before deep drilling activity is initiated, and careful monitoring of any large-scale withdrawal is stressed because of potential danger of thermal and fluoride pollution of drinking water. (Eberle-NWWA)
W77-12782

HEAD GRADIENT CONTROL IN AQUIFERS USED FOR FLUID STORAGE

Auburn Univ., Ala. Dept. of Civil Engineering.
F. J. Molz, and L. C. Bell.
Water Resources Research, Vol. 13, No. 4, p 795-798, August 1977. 3 fig, 19 ref.

Descriptors: *Aquifers, *Hydraulic gradient, *Storage, *Model studies, Mathematical models, Groundwater, Groundwater movement, Wells, Water wells, Pumping, Buoyancy, Aquifer management.
Identifiers: *Fluid storage.

Attempts to store fluids in confined aquifers sometimes are frustrated by regional groundwater flow and/or by buoyancy drift due to density differences between the stored fluid and the native groundwater. Such effects can be largely overcome through the use of gradient control wells. A procedure based on linear programming can be used for the initial design of a well field that will create a zero gradient of a finite gradient in a given

region. The finite difference form of the steady-state groundwater equation provided one set of constraints, while the gradient condition in the storage region provided a second set. A standard linear programming solution routine was used then to provide the minimum pumping rates and head distribution consistent with the constraints and the chosen well array. (Sims-ISWS)
W77-12800

THE UNSTEADY GROUNDWATER MOUND BELOW AN IRRIGATION DITCH OR LEAKY CANAL

Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 2G.
W77-12801

LAND SUBSIDENCE AND CRACKING DUE TO GROUND-WATER DEPLETION

Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 2F.
W77-12803

HYDROGEOCHEMICAL RELATIONSHIPS DURING PARTIAL CORRELATION COEFFICIENTS

Texas Christian Univ., Fort Worth. Environmental Sciences Program.
For primary bibliographic entry see Field 2F.
W77-12808

U.S.S.R.: GOLODNAYA (HUNGRY) STEPPE, (CASE STUDY OF DESERTIFICATION)

Ministry of Reclamation and Water Management, Moscow (USSR).
For primary bibliographic entry see Field 3C.
W77-12825

NITRATE-N PERCOLATION THROUGH IRRIGATED SANDY SOIL AS AFFECTED BY WATER MANAGEMENT

Agricultural Research Service, Akron, Colo.
For primary bibliographic entry see Field 5B.
W77-12830

WATER PROJECTS GO UNDERGROUND

Southern California Metropolitan Water District, Los Angeles.
U. E. Gleason.
Ecology Law Quarterly, Vol 5, No 4, p 625-68, 1976.

Descriptors: *California, *Imported water, *Underground storage, *Artificial recharge, Water supply, Water storage, Storage capacity, Dependable supply, Groundwater, Induced infiltration, Groundwater recharge, Seepage, Surface-groundwater relationships, Water distribution (Applied), Judicial decisions, Legal review, Water law, Pueblo water rights, Prescriptive rights, Prior appropriation.
Identifiers: Overlying rights, *Groundwater management, California State Water Project, Water rights(Non-riparians).

Recently California courts have affirmed the public's right to store, protect and retrieve imported water in natural underground basins. This will alleviate the need for additional dams by providing a ready means to capture, during the rainy season, the excess water which usually escapes unused. Underground water storage is accomplished through the process of artificial recharge. California is now preparing to use underground water storage facilities in its multi-billion dollar state water system. One legal problem still requiring clarification is the exchange storage situation which results when a groundwater right owner forgoes the extraction of a certain amount of groundwater by substituting imported surface

water supplies. An additional problem is establishing a priority list for underground storage in areas where the storage space is limited. Obviously the overlying communities should get first priority. Perhaps one of the most significant consequences of the recent judicial action in California is the current public concern that the state's existing resources, both natural and man-made, should be used to their fullest extent. (Moorhouse-Florida)
W77-12886

LAW OF GROUND WATER IN PENNSYLVANIA

Pennsylvania Dept. of Environmental Resources, Harrisburg.
R. T. Weston, and M. W. Gang.
Dickinson Law Review, Vol 81, No 1, p 11-63, Fall 1976.

Descriptors: *Pennsylvania, *Groundwater, *Percolating water, *Underground streams, Sub-surface waters, Aquifers, Surface-groundwater relationships, Relationships, Groundwater resources, Competing use, Common law, Water allocation(Policy), Natural flow doctrine, Riparian rights, Flow, Springs, Groundwater movement, Interstate commissions, Delaware River Basin Commission, Regulation, State governments, Federal government.

Identifiers: *Groundwater management, Susquehanna River Basin Commission, State policy.

The development of Pennsylvania's economy is largely based upon the state's abundant water resources of which seventy percent are ground waters. The authors have surveyed the law of ground water in Pennsylvania. The courts apply riparian principals to known underground streams while allowing unlimited use of percolating ground waters. Evidentiary problems exist in demonstrating the existence of an underground stream. Although use of percolating waters has been deemed unlimited, property owners must deal with competing uses of adjacent landowners. The major competing uses are interferences from mining, multiple activities on the same land, prescriptive rights and pollution of ground water. The common law approaches to ground water use and allocation provide the primary legal foundation for resolving conflicts as no statutory or regulatory program comprehensively addresses the issue. However, the Delaware and Susquehanna River Basin Commissions are playing an increasingly greater role in managing the ground waters of the eastern two-thirds of the state. The present law governing ground water in Pennsylvania is a confused mesh of doctrines, rules, distinctions and exceptions based on incorrect and incomplete scientific data. A reasonable and comprehensive set of water policies and laws are needed. (Moorhouse-Florida)
W77-12887

4C. Effects On Water Of Man's Non-Water Activities

LIVING FENCEROWS OF THE RIO SAN MIGUEL, SONORA, MEXICO: TRADITIONAL TECHNOLOGY FOR FLOODPLAIN MANAGEMENT

Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 3B.
W77-12293

POTENTIAL WATER YIELD RESPONSE FOLLOWING CLEARCUT HARVESTING ON NORTH AND SOUTH SLOPES IN NORTHERN IDAHO

Intermountain Forest and Range Experiment Station, Ogden, Utah.
R. G. Cline, H. F. Haupt, and G. S. Campbell.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4C—Effects On Water Of Man's Non-Water Activities

Research Paper INT-191, Ogden, Utah, June, 1977. 16 p, 2 fig, 3 illus, 24 ref, 6 tab.

Descriptors: *Water yield, *Clear-cutting, *Watershed management, *Idaho, Soil moisture, Snowmelt, Infiltration, Lumbering, Hydrology, Water resources, Surface waters, Water yield improvement, Runoff, Water supply, Slopes.

The hydrologic response of small clearcuts on north and south slopes in northern Idaho was investigated. On the north slope, substantial gains (27 to 35 cm) in potential water yield per year resulted from (a) removal of transpiring surfaces associated with plant cover, (b) elimination of snow interception by a closed-canopied forest, and (c) delayed reoccupancy of the soil mantle by invading herbaceous species. On the south slope, small to moderate gains (4 to 11 cm) in yield resulted from clearcutting, at least in 1973, the year studied. (Witt-IPC)
W77-12366

CASE STUDY OF A WATERSHED REHABILITATION PROJECT: ALKALI CREEK, COLORADO,
Rocky Mountain Forest and Range Experiment Station, Tempe, Ariz.
For primary bibliographic entry see Field 4D.
W77-12367

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME IV. OVERLAND FLOW ON AREAS SUBJECT TO INFILTRATION LOSSES,
Maryland Univ., College Park. Dept. of Civil Engineering.
D. W. Street, and R. M. Ragan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 455.
Price codes: A06 in paper copy, A01 in microfiche.
Report No. AWO74-073-046-4, July 1974. 114 p, 11 fig, 98 ref, 6 append. AWO74-073-046.

Descriptors: *Urban runoff, *Surface runoff, *Infiltration, *Model studies, Mathematical models, Computer models, Computer programs, Pervious soils, Hydrographs, Runoff, Storage, Computers, Flow, Storm runoff, Cities, Urbanization, Urban hydrology, Overland flow, Drainage.

The report described the results of a series of computer simulations of overland flow over pervious surfaces in urban areas. The work was one phase of the development of a mathematical model for the computation of runoff hydrographs in urban areas. The report described that portion of the overall model concerned with runoff from pervious surfaces. The infiltration abstraction, as described in this paper, is the single most important factor in computing the runoff hydrograph over pervious surfaces. Also included was a survey of all pertinent information available in the literature on the subject of infiltration capacities which is applicable for practical use in overland flow studies in urban areas. An appendix contained the listing of the computer program used. (See also W77-12548, W77-02180 and W77-02490 thru W77-02493). (Sims-ISWS)
W77-12547

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME V. A DIMENSIONLESS HYDROGRAPH FOR ESTIMATING STORM RUNOFF FROM URBAN AREAS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. M. Ragan, and J. F. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 456.
Price codes: A08 in paper copy, A01 in microfiche.
Report No. AWO74-073-046-5, July 1974. 164 p, 29 fig, 4 tab, 28 ref, 4 append. AWO74-073-046.

Descriptors: *Urban runoff, *Hydrographs, *Model studies, Mathematical models, Computer

models, Computer programs, Drainage, Computers, Storm runoff, Flow, Watersheds(Basins), Cities, Urbanization, Urban hydrology.

A number of mathematical models used to estimate storm hydrographs in urban areas consider runoff as a deterministic process and link a series of submodels to simulate the behavior of the various components of the runoff cycle. Because of the number of inter-related formulations in the linked system models, a large core computer generally is required for their proper use. The report presented a dimensionless inlet hydrograph that can be developed from a complete linked system model and can be used as a substitute in some planning and design situations. The central objective was to develop a method for estimating the hydrograph entering an inlet or catch basin that would be simple enough to allow hand entering an inlet or catch basin that would be simple enough to allow hand computations while retaining good agreement with the computer generated hydrographs obtained with a complete linked system model. Computer programs were included in the appendixes. (See also W77-12547, W77-02180, and W77-02490 thru W77-02493) (Sims-ISWS)
W77-12548

THE IMPACT OF ENERGY DEVELOPMENT ON WATER RESOURCES IN THE UPPER COLORADO RIVER BASIN,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3E.
W77-12630

EFFECTS OF MAN ON SEDIMENTATION AND EROSION IN RURAL ENVIRONMENTS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 4D.
W77-12843

4D. Watershed Protection

AN INDEX FOR PREDICTING SURFACE WATER QUALITY BASED ON THE VEGETATION OF THE WATERSHED,
Arizona Univ., Tucson. Dept. of Ecology and Evolutionary Biology.
For primary bibliographic entry see Field 5A.
W77-12262

EFFECTS OF CHANGE IN STREAM REGIMEN BELOW GLEN CANYON DAM ON THE MORPHOLOGY OF THE COLORADO RIVER,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2J.
W77-12265

LIVING FENCEROWS OF THE RIO SAN MIGUEL, SONORA, MEXICO: TRADITIONAL TECHNOLOGY FOR FLOODPLAIN MANAGEMENT,
Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 3B.
W77-12293

EFFECTS OF SOIL, COVER CROP, AND NUTRIENT SOURCE ON MOVEMENT OF SOIL, WATER, AND NITROGEN UNDER SIMULATED RAIN-SLOPE CONDITIONS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 2B.
W77-12309

URBAN RUNOFF DIGITAL COMPUTER MODEL,
Khonkaen Univ. (Thailand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-12316

MOVEMENT OF COBBLES IN A GRAVEL-BED STREAM DURING A FLOOD SEASON,
California Univ., Berkeley. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W77-12318

STREAM JUNCTIONS-A PROBABLE LOCATION FOR BEDROCK PLACERS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 2J.
W77-12322

POTENTIAL WATER YIELD RESPONSE FOLLOWING CLEARCUT HARVESTING ON NORTH AND SOUTH SLOPES IN NORTHERN IDAHO,
Intermountain Forest and Range Experiment Station, Ogden, Utah.
For primary bibliographic entry see Field 4C.
W77-12366

CASE STUDY OF A WATERSHED REHABILITATION PROJECT: ALKALI CREEK, COLORADO,
Rocky Mountain Forest and Range Experiment Station, Tempe, Ariz.
B. H. Heede.
Research Paper RM-189, Tempe, Arizona, June, 1977. 18 p, 2 fig, 13 illus, 16 ref, 7 tab.

Descriptors: *Watershed management, *Erosion control, *Vegetation establishment, *Colorado, Check structures, Dams, Gully erosion, Gullies, Grassed waterways, Rocky Mountain Region, Water supply development.
Identifiers: *Alkali Creek(Colorado).

The headwaters of Alkali Creek watershed were fenced, and cattle grazing was excluded from 1958 to 1966. In 1963, check dams or vegetation-lined waterways were constructed in about one-half of the gullies. Seven years later (1970), the ephemeral flow became perennial. Vegetation cover improvement and formation of additional alluvial water reservoirs in the gullies above the check dams are considered to be responsible for this change. Treated waterways experienced only one-third of the net erosion of untreated gullies. An empirical equation expressed relationships between original gully gradient and deposit gradient above check dams. The overall goal of the treatment was achieved. (Witt-IPC)
W77-12367

URBAN RUNOFF CHARACTERISTICS: VOLUME II - FIELD INVESTIGATIONS,
Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W77-12478

CATCHBASIN TECHNOLOGY OVERVIEW AND ASSESSMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5D.
W77-12495

EFFECTS OF DESIGN FACTORS ON SEDIMENTATION BASIN PERFORMANCE,
Minnesota Dept. of Natural Resources, St. Paul.
A. B. Pennell, and C. L. Larson.

Paper No. 76-2020, Presented at the Annual Meeting of the American Society of Civil Engineers, June 27-30, 1976, Lincoln, Nebraska. 14 p, 6 fig, 26 ref.

Descriptors: Sedimentation, Model studies, Simulation analysis, Mathematical studies, Sediments, *Sediment control, *Settling basins, *Design criteria, *Mathematical model, *Detention.

A mathematical model designed to evaluate sedimentation basin performance as affected by variations in design factors produces trap efficiency curves showing that, beyond capacity, the most significant factors are basin depth and length of detention time. In field application, these factors take on a higher degree of significance in the ability of the user to manipulate them as required by site-specific conditions and trap efficiency goals. The relationship of variations in these factors in obtaining a desired output is illustrated. The results obtained are limited in that they are based on a mathematical model developed with certain assumptions. Also, data were not available for testing the model. Accordingly, the absolute values as presented may be somewhat in error. However, the comparative values and the relative effects should be reliable. (Skogerboe-Colorado State)

W77-12514

DEMONSTRATION OF COAL MINE HAUL ROAD SEDIMENT CONTROL TECHNIQUES, Mayes, Sudderth and Etheredge, Inc., Lexington, K.Y.

For primary bibliographic entry see Field 5G.
W77-12559

PROTECTION OF SLOPES AGAINST RAINFALL EROSION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. E. B. Perry.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A016 147, Price codes: A03 in paper copy, A01 in microfiche. Final Report, September 1975. 41 p, 2 fig, 108 ref, 1 append. ARO 1T161102B52B.

Descriptors: *Erosion, *Slope protection, Erosion control, Soil erosion, Rainfall simulators, Vegetation effects, Sediment control, Rainfall, Stabilization, Laboratory tests, Spraying.
Identifiers: *Spray-on stabilizers, *Rainfall erosion, Rainfall erosion process, Spray-on chemicals.

Commercially available spray-on stabilizers are represented as being capable of controlling soil erosion between the time of slope construction and establishment of a vegetative cover. This study presented a review of previous research on rainfall erosion process, mechanics of rainfall erosion, characteristics of natural rainfall, rainfall simulators, studies of rainfall erosion of soils, and studies of rainfall erosion of laboratory rainfall simulator. An experimental study was to have been conducted using the rainfall simulator to determine the effectiveness of selected stabilizers in controlling rainfall erosion. Use of soil samples composed of various percentages of sand-silt-clay was planned so that the results could be generalized to any particular soil type. This study was terminated due to lack of funding. (Lee-ISWS)

W77-12561

REPORT ON STATE SEDIMENT CONTROL INSTITUTES PROGRAM.

Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards. For primary bibliographic entry see Field 5G.
W77-12565

TWO-DIMENSIONAL MODEL OF EROSION FROM A WATERSHED,

Texas A and M Univ., College Station. Dept. of Agricultural Engineering.

H-c. Kuh, D. L. Reddell, and E. A. Hiler.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 26 p, 3 fig, 2 tab, 6 ref.

Descriptors: *Model studies, Simulation analysis, Sediments, Sedimentation, *Erosion control, Watersheds(Basins), *Watershed management.

A two-dimensional model of erosion from a small watershed is described. The model provides estimates of the amount of sediment eroded from a watershed plus the areal distribution of erosion or deposition on the watershed. Predicted values are compared with measured data from individual storms over an 11-year period with excellent agreement. Results are also compared with estimates of erosion made by the original and modified versions of the Universal Soil Loss Equation. (Skogerboe-Colorado State)

W77-12575

CORN-SOYBEAN TILLAGE SYSTEMS: EROSION CONTROL, EFFECTS ON CROP PRODUCTION, COSTS,

Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 3F.

W77-12576

GRASSLAND RENOVATION - CONSERVES SOIL AND ENERGY AND INCREASES RETURNS FROM GRASS FIELDS,

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.

E. M. Smith, and J. K. Evans.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 12 p, 1 fig, 3 tab, 14 ref.

Descriptors: *Grasslands, *Soil erosion, Fertilization, Nitrogen, Legumes, *Vegetation regrowth.
Identifiers: *Grassland renovation.

A grassland renovation seeder has been developed to interseed legumes into existing grass fields. This seeder disturbs less than ten percent of the grass sod. Most of the sod remains to prevent soil erosion, even on steep slopes. Grass fields which were renovated with a grassland renovation seeder by planting 6 pounds of red clover seed per acre required an energy investment of 0.023 times 1,000 KCal. per acre each year for seed and tractor fuel to operate the grassland renovation seeder. Nitrogen fertilization of grass fields with 150 pounds of nitrogen per acre each year required an energy investment of 1.27 times 1,000 KCal. per acre each year. Nitrogen fertilization of grass fields requires an energy input of 55 KCal. as compared with each KCal. of energy input when the new grassland renovation unit is used instead of nitrogen. Potential returns in the form of beef produced on the grass fields per 100 brood cows was increased from 25,272 pounds with nitrogen fertilization to 40,112 pounds with grassland renovation to obtain a clover grass mixture. Grassland renovation yielded 1.59 pounds of beef for each pound with nitrogen fertilization. (Skogerboe-Colorado State)

W77-12622

CONSERVATION TILLAGE - EFFECTS ON CROP PRODUCTION AND SEDIMENT YIELD,

Purdue Univ., Lafayette, Ind. Dept. of Agronomy.

For primary bibliographic entry see Field 3F.

W77-12626

STOCHASTIC APPROACH TO THE COLORADO RIVER BASIN,

Bureau of Reclamation, Denver, Colo. Water Utilization Branch.

W. L. Lane, A. E. Gibbs, and R. B. Main.

Presented at the National Water Resources and Ocean Engineering Convention of the American Society of Civil Engineers, April 5-8, 1976, San Diego, California, 25 p, 4 fig, 1 tab, 6 ref. Preprint 2684. \$1.00.

Descriptors: Hydrology, Rivers, River basins, River systems, Dissolved solids, Water quality, Colorado river, *Colorado river basin, Salinity, *Stochastic processes.

The stochastic approach to hydrology may be successfully applied to large river basins with several interdependent tributary inflows. Quality, specifically total dissolved solids, may be successfully generated jointly with flow. In actual application to the Colorado River Basin, results were obtained which are valuable for planning and evaluation purposes. By using stochastically generated flows and qualities, the effects of various structural or nonstructural measures in the basin may be more realistically assessed under a variety of potential future flow and salinity conditions. If the measures had been analyzed with the set of historical flows and salinities, the assessment would have been incomplete and biased. This approach is expected to be applicable to other basins with similar success. (Skogerboe-Colorado State)

W77-12724

A FINITE ELEMENT DISTRIBUTED CATCHMENT MODEL, I. ANALYTICAL BASIS,

King's Coll., London (England). Dept. of Civil Engineering.

For primary bibliographic entry see Field 2A.
W77-12798

STREAM NETWORK VOLUME: AN INDEX OF CHANNEL MORPHOMETRY,

Southampton Univ. (England). Dept. of Geography.

For primary bibliographic entry see Field 2E.
W77-12802

EROSION AND SEDIMENT CONTROL AUDIOVISUAL TRAINING PROGRAM, INSTRUCTOR'S MANUAL,

Hittman Associates, Inc., Environmental and Geosciences Dept.

For primary bibliographic entry see Field 5G.
W77-12815

EFFECTS OF MAN ON SEDIMENTATION AND EROSION IN RURAL ENVIRONMENTS,

Research Inst. for Water Resources Development, Budapest (Hungary).

L. Rakoczi.

Hydrological Sciences Bulletin, Vol. 20, No. 1, p. 103-112, March, 1975. 16 ref.

Descriptors: *Sedimentation, *Erosion control, *Soil erosion, *Environmental effects, *Sediment yield, Erosion, Rural areas, Human effects, Water, Hydrology, Erosion rates, Agriculture, Farming, Grazing, Mathematical models, Regression analysis, Semiarid climates.

Summaries of papers given at a 1974 conference held in Paris on the Effects of Man on the Interface of the Hydrological Cycle with the Physical Environment are presented. The papers are concerned only with man made erosion that occurs in rural areas. They are grouped into three categories: (1) the effects of agriculture on erosion, (2) changes in the rate of erosion and sedimentation due to deforestation, and (3) empirical formulae for calculation of sediment yield and methods for presenting erosion processes in maps. The sub-

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Group 4D—Watershed Protection

jects dealt with included sedimentation in the Colorado River, grazing control in semiarid regions, the effect of land treatment on runoff and erosion, man's impact on landmass erosion in a semiarid region of India, the effect of coniferous afforestation on small drainage basins, and mathematical models for calculating sediment yield. World wide research on erosion problems is necessary and useful since soil erosion and sedimentation are a substantial part of the overall deterioration of the environment. (Jamail-Arizona) W77-12843

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

METALS IN THE WATER, SEDIMENTS AND BIOTA OF THE HAW AND NEW HOPE RIVERS, NORTH CAROLINA. North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering. M. S. Shuman, L. A. Smock, and C. L. Haynie. Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 629. Price codes: A07 in paper copy, A01 in microfiche. UNC-WRRI Report No. 124, 3 fig, 31 tab, 127 p, May 1977. A-070-NC, 14-31-0001-4033

Descriptors: Water pollution sources, *Heavy metals, Sediments, *Neutron activation analysis, Metal concentrations, *Metal transport, Water sampling, Industrial wastes, Municipal wastes. Identifiers: Haw and New Hope Rivers, North Carolina, Heavy metals.

Neutron activation analysis was used to investigate the concentrations of Co, Cr, Fe, K, Mn, Na, Sb, Sc and Zn in the filtrable (<0.45 microgram), suspended particulate and sediment phases as well as in the benthic macroinvertebrates of two central North Carolina river systems. Data collected provided information on the partitioning of metals among these abiotic and biotic phases, on the influence of sediment particle size on metal concentrations and on the various geochemical modes by which metals were transported by suspended particulate matter. Data from the macroinvertebrates provided information on the importance of feeding habits, species, organism size and metal-metal and metal-sediment interactions on metal concentrations in these organisms. Suspended particulate matter generally had the highest metal concentrations. Filtrable metal concentrations had the least spatial and temporal variation while suspended metal concentrations had the greatest variations. Incorporation into Fe and Mn oxides was the most important mode of metal transport under polluted and low flow conditions while transport as crystalline minerals was most important under control and high flow conditions. Zn and Mn had the highest concentration factors in the benthic macroinvertebrates. The greater the organism-sediment contact, especially in terms of feeding habits, the higher the metal concentrations in the organisms. Biomagnification was generally unimportant for the metals and species examined. Smaller organisms had higher metal concentrations. The biota more clearly reflected industrial inputs of Cr and Sb into the river systems than did the abiotic phases examined. W77-12254

AN INDEX FOR PREDICTING SURFACE WATER QUALITY BASED ON THE VEGETATION OF THE WATERSHED. Arizona Univ., Tucson. Dept. of Ecology and Evolutionary Biology. E. A. Stull. Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 624, W77-12260

Price codes: A03 in paper copy, A01 in microfiche. Completion Report, August, 1977. 24 p, 5 fig, 8 tab, 11 ref. OWRT A-071-ARIZ.(1) 14-34-0001-7006.

Descriptors: *Water quality, Lakes, *Geochemistry, Sodium, Salinity, Arizona, Arid lands, *Ions, *Forecasting, *Regional analysis, *Vegetation, Classification, Watershed management, *Geography, Cations, Anions.

Regional patterns of water quality in an arid environment are described. Comparative regional information is necessary to establish average conditions, to understand the processes that produce deviations from average conditions, and to construct models which can be used to predict the water quality of lakes under consideration for construction. In this study 23 lakes were visited twice during the summer of 1976. For each, 33 parameters of water quality, basin morphometry, and climate were assembled. The lakes were dilute to weakly saline as measured by specific conductance. Average chemical composition for the lakes was 226 umhos/cm specific conductance, 12.5 mg/l Ca, 9.0 mg/l Mg, 18.5 mg/l Na, 90.6 mg/l alkalinity, 28.1 mg/l SO₄, 18.3 mg/l Cl, 4.2 mg/l K, and 3.7 mg/l SiO₂. Calcium and carbonates were the most abundant ions in the majority of the lakes, although sodium chloride and calcium sulfate lakes were also found. Altitude and climate were strongly correlated. Geographic patterns of chemical composition corresponded to those of altitude and climate. Both the concentration and proportion of major ions were correlated to altitude and climate. The relative proportion of sodium increased with increasing salinity of the surface waters. Although problems with collinearity were great, parameters of climate and basin morphometry were good descriptors of the variation in conservative chemical constituents of the lake waters. Chemical constituents which are major plant nutrients showed little tendency to be sensitive to the geographic variations which were important for the conservative constituents. Regional variations in water quality in Arizona were predictable, and its concluded this predictability will allow the development of useful models of water quality based on parameters of geography and climate. W77-12262

ATMOSPHERIC ENHANCEMENT OF METAL DEPOSITION IN ADIRONDACK LAKE SEDIMENTS. Cornell Univ., Ithaca, N.Y. J. N. Galloway, and G. E. Likens. Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 730. Price codes: A03 in paper copy, A01 in microfiche. Technical Report, Cornell University Center for Environmental Research, Ithaca, New York, July 1977. 40 p, 15 fig, 5 tab, 19 ref. OWRT A-067-NY(1), 14-34-0001-6033.

Descriptors: Metals, Lakes, Sediments, Paleolimnology, *Lake sediments, *Trace elements, *Pollutant identification, Neutron activation analysis, *Spectroscopy, *Air pollution effects, New York. Identifiers: *Trace metals, Adirondack Lakes(NY).

Sediment cores were collected from Woodhull Lake, Adirondack State Park, New York in July, 1975. Analysis of metals by neutron activation and atomic adsorption spectroscopy was performed. Of the 44 metals analyzed, Ag, Au, Cr, Ni, Pb, Sb and V increased rates of deposition in recent times. These increases are caused by increased rates of atmospheric deposition of metals. These results are substantiated by similar studies done on cores from Honnedaga Lake, Adirondack State Park, New York and Lake of the Clouds, Mt. Washington, New Hampshire. W77-12270

THE DETERMINATION OF TOTAL NITROGEN IN SEDIMENTS USING AN INDUCTION FURNACE. Canada Centre for Inland Waters, Burlington (Ontario). H. K. T. Wong, and A. L. W. Kemp. Soil Science, Vol 124, No 1, p 1-4, May 1977. 4 tab, 12 ref.

Descriptors: *Nitrogen, *Great Lakes, *Sediments, *Nitrogen compounds, *Analytical techniques, *Soil analysis, Ammonia nitrates, Bottom sediments, Lake sediments, Soils, Analysis, Chemistry, Instrumentation, Chemical analysis, Pollutant identification. Identifiers: *Total nitrogen determination, *Induction furnace method, Total nitrogen, Kjeldahl method, Organic forms, Dry-combustion method, Coleman Model 29A analyzer, Dumas analysis, Nitrogen analyzer.

Total nitrogen was determined in sediments by the high temperature combustion (about 2600 C) method of Dumas, using an induction furnace system. Nitrogen analyses were carried out on 6 chemical compounds and 18 sediment samples. The reproducibility and accuracy of the analyzer were evaluated. The automated system gave the same total nitrogen values in the sediment samples as the conventional Kjeldahl procedure. (Henley-ISWS) W77-12313

MASS SPECTROMETRIC ANALYSIS OF PRODUCT WATER FROM COAL GASIFICATION. Energy Research and Development Administration, Pittsburgh, Pa. Pittsburgh Energy Research Center. C. E. Schmidt, A. G. Sharkey, Jr., and R. A. Friedel. Available from the National Technical Information Service, Springfield, VA 22161 as PB-240 835. Price codes: A02 in paper copy, A01 in microfiche. Technical Progress Report 86, December 1974. 9 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Coals, *Phenols, *Chemical analysis, *Water pollution, *Mass spectrometry, Analytical techniques, Water pollution sources, Coal mines, Water quality, Analysis, Gas chromatography, Chemistry, Wastes, Pollutant identification, Organic compounds, Natural gas, Separation techniques, Trace elements, Pollutants. Identifiers: *Coal gasification, *Mass spectrometric analysis, *Product water, *Synthane process, *Phenolic compounds, Organic contaminants, Extraction, Methylene chloride, Cresol, Product water contaminants.

Condensate waters from the Bureau of Mines Synthane process for coal gasification were investigated by mass spectrometric methods to determine the organic contaminants. Waters from the gasification of 6 coals were extracted with methylene chloride, yielding 0.6 to 2.4 weight-percent extractable material. Using high-resolution mass spectrometry (HRMS), combined gas chromatography-mass spectrometry (GC-MS), and low-voltage mass spectrometry, 60 to 80% of the extract was found to be phenolic. About 20 organic contaminants were identified and were present in the condensate waters from each coal gasified. The relative distribution of contaminants in the condensate water was nearly the same for the 6 coals gasified under various conditions; phenolic compounds were the most abundant in all cases. (Henley-ISWS) W77-12328

FLUORESCENCE TRACING OF THE FLOW AND DISPERSION OF SULFITE WASTES IN A FJORD SYSTEM. Goteborg Univ. (Sweden). Institutionen for Analytisk Kemi. For primary bibliographic entry see Field 5B.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants—Group 5A

W77-12333

PROTOZOA AS TEST ORGANISMS FOR THE EVALUATION OF THE PROPERTIES OF EFFLUENTS (PROSTEISHIE MIKROORGANIZMY KAK TEST-OB"YEKTY DLYA OTSENKI SVOISTV STOCHNYKH VOD), M. A. Lomova, A. F. Martynova, and G. G. Litvinov.

Descriptors: *Effluents, *Toxicity, *Protozoa, *Pulp wastes, Aquatic microorganisms, Wastes, Industrial wastes, Water pollution sources, Foreign countries, Water pollution effects, Activated sludge, Bleaching wastes, Waste dilution, Neutralization, Mixing, Alcohols, Bioassay, *Bioindicators, Pollutant identification. Identifiers: USSR, Spent pulping liquors, Condensates, Barking effluents.

A method has been developed at the All-Union Research Institute of the Pulp and Paper Industry (USSR) for determining the toxicity of effluents or their components to activated sludge. Results are given of tests conducted with Ciliata species (*Paramecium caudatum*, *Aspidisca costata*, *Euplothes sharon*, *Stolonichia pustulata*, and an *Axytricha* species) as test organisms, to determine the toxicity of 18 types of effluents from the Kotlas wood-processing complex (including spent pulping liquors, bleaching effluents, evaporator crude condensates, effluents from the production of constructional fiberboards, sulfite alcohol, and wood chemicals, and barking effluents), and of the overall effluent of the complex. The survival rate of the protozoa was taken as the toxicity criterion. Only bleaching effluents and the crude condensate from evaporators were found to be lethal, even when diluted. The nontoxicity of the overall effluent can be attributed partly to dilution and partly to neutralization of some toxic substances during mixing of the individual effluents. (Stapinski-IPC) W77-12349

POTENTIOMETRIC DETERMINATION OF MICROAMOUNTS OF SULFUR COMPOUNDS IN KRAFT MILL EFFLUENTS (POTENSIOMETRICHESKOE OPREDELENIIE MIKROKOLICHESTV SERNISTYKH SOEDINENII V STOCHNYKH VODAKH SUL'FATSELLYULOZNOGO PROIZVODSTVA), S. S. Zhustareva, V. G. Krunchak, A. V. Ukhima, and L. S. Reishakhrit. Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tsellyulozno-Bumazhnoi Promyshlennosti, No. 67, p 160-164, 1975. 3 fig, 7 ref.

Descriptors: *Pulp wastes, *Sulfur compounds, *Water analysis, *Pollutant identification, Wastes, Industrial wastes, Water pollution sources, Effluents, Pulp and paper industry, Sulfides, Electrodes, Analytical techniques, Trace elements, Water chemistry, Waste water treatment, Water purification. Identifiers: *Potentiometry.

With the introduction of new purification methods for pulp and paper industry effluents, there is a need for a method for the determination of very small amounts of sulfur compounds, such as inorganic sulfides, organic disulfides, and thiols. Such method is described based on potentiometric titration with ammoniacal silver nitrate solution, using a sulfite-silver electrode in a helium atmosphere. Aqueous ethanol, acetone, or dioxane is used as solvent, and a calomel electrode as reference electrode. Potentiometric titration curves obtained for model solutions are presented and discussed. The accuracy of the determination is plus or minus 3%. Also presented are curves showing the dependence of the initial potential of the electrode on the concentration of sulfur compounds. The initial potential can be used for direct determination

(without titration) of inorganic sulfides in the presence of organic disulfides; as for the latter, the initial potential remains constant within the 0.4-4 mg/liter concentration range. (Stapinski-IPC) W77-12354

USE OF PYROLYSIS/GAS-CHROMATOGRAPHY IN ANALYZING LOW-VOLATILITY ORGANIC WATER POLLUTANTS (DIE ANWENDUNG DER PYROLYSE-GASCHROMATOGRAPHIE ZUR ANALYTIK VON SCHWERLUECHTIGEN ORGANISCHEN WASSERINHALTSSTOFFEN), Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie. L. Stieglitz, and W. Leger. Vom Wasser, Vol 45, p 233-251, 1975. 11 fig, 20 ref, 1 tab.

Descriptors: *Water analysis, *Gas chromatography, *Organic compounds, *Pollutant identification, Analytical techniques, Pulp wastes, Wastes, Water pollution sources, Industrial wastes, Mass spectrometry, Carbon, Lignins, Waste identification. Identifiers: *Pyrolysis, Lignosulfonic acid, Rhine River (Germany).

In various investigations, successful identification and determination of organic water pollutants has been achieved through the combination of gas chromatography with mass spectrometry. This technique is limited, however, to substances of adequate volatility. Indications are that only 10-30% or dissolved organic carbon compounds meet this requirement. An extension of the method to organic material of low volatility was attempted using pyrolysis/gas-chromatography. Through combination with mass spectrometry, a direct identification of the pyrolysis products and, consequently, of the structural units of the macromolecules was feasible. Two different pyrolysis methods (resistance- and Curie-point-pyrolysis) were applied, and the product yield was improved. For lignosulfonic acid (a major pollutant of Rhine river water) the characteristic pyrolysis products identified are guaiacol, veratrole, m-methoxyacetophenone, and isoeugenol. A quantitative determination with relative standard deviations of 10-30% is possible with 50-500 micrograms of material. Samples obtained by solvent extraction of paper mill effluents were investigated. The results show that different lignosulfonic acids may be characterized according to a fingerprint method. (Speckhard-IPC) W77-12363

AVAILABILITY OF WATER IN THE FLORIDAN AQUIFER IN SOUTHERN DUVAL AND NORTHERN CLAY AND ST. JOHNS COUNTIES, FLORIDA, Geological Survey, Tallahassee, Fla. Water Resources Div. For primary bibliographic entry see Field 4B. W77-12374

GROUND-WATER QUALITY NEAR A SEWAGE-SLUDGE RECYCLING SITE AND A LANDFILL NEAR DENVER, COLORADO, Geological Survey, Lakewood, Colo. Water Resources Div. For primary bibliographic entry see Field 5B. W77-12382

TEST-WELL DRILLING IN THE UPPER SATUS CREEK BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON, Geological Survey, Tacoma, Wash. Water Resources Div. For primary bibliographic entry see Field 4B. W77-12384

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1976. Geological Survey, Carson City, Nev. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12386

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1976. Geological Survey, University, Ala. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12387

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1976. Geological Survey, Columbia, S.C. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12388

WATER RESOURCES DATA FOR KENTUCKY, WATER YEAR 1976. Geological Survey, Louisville, Ky. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12389

HYDROGEOLOGIC DATA FROM INVESTIGATION OF WATER RESOURCES OF THE SOUTH FORK, SUFFOLK COUNTY, NEW YORK, Geological Survey, Mineola, N.Y. Water Resources Div. For primary bibliographic entry see Field 7C. W77-12390

FRESH-WATER RESOURCES IN THE SOUTHEASTERN PART OF THE TULAROSA BASIN, Geological Survey, Austin, Tex. Water Resources Div.; and Geological Survey, Albuquerque, N. Mex. Water Resources Div. For primary bibliographic entry see Field 4A. W77-12392

WATER QUALITY MANAGEMENT—THE MANAGEMENT INFORMATION REQUIREMENT, For primary bibliographic entry see Field 5G. W77-12394

NEW OXYGEN METERS. Effluent and Water Treatment Journal, Vol. 17, No. 6, p 299, June, 1977.

Descriptors: *Equipment, *Monitoring, *Dissolved oxygen analyzers, *Electrodes, *Dissolved oxygen, Instrumentation, Water quality, Sewage treatment, *Waste water treatment.

A series of Lovibond dissolved oxygen meters are being marketed by The Tintometer Limited of Salisbury, England. The instruments utilize a Messtronik electrode which contains a large gold cathode, a liquid electrolyte, and a pressure-compensating diaphragm for measurements at greater depths. Bench and portable models with a wide variety of optional features are available, including measurements of dissolved oxygen and temperature, automatic agitation, multi-probe measurements, and data recorders. Dissolved oxygen meters may be used in monitoring sludge digestion in sewage treatment facilities. (Schulz-FIRL) W77-12399

METERING TOTAL OXYGEN DEMAND, Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands). Application Lab. G. Voorn, and J. S. Marlow.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

Effluent and Water Treatment Journal, Vol 16, No 6, p 301-306, June, 1977. 8 fig, 6 tab, 3 ref.

Descriptors: *Dissolved oxygen analyzers, *Dissolved oxygen, *Biochemical oxygen demand, *Chemical oxygen demand, *Instrumentation, Electric potential, Electrochemistry, Electrodes, Industrial wastes, Chemical wastes, Municipal wastes, Aerobic conditions, Sewage treatment, *Waste water treatment.

Identifiers: *Total oxygen demand, Faraday's Law, Nernst's Law.

Analysis of total oxygen demand (TOD), measured by combustion at 900°C of oxidizable material in a water sample, is suggested as an alternative to traditional measurement of biochemical oxygen demand (BOD) and chemical oxygen demand (COD). A TOD meter which is based on electrochemical relationships as defined by Faraday's Law and Nernst's Law is described. In the Phillips TOD meter, zirconium oxide electrodes are used to measure oxygen-generated electrical potential with nitrogen as a carrier gas. Special features and operating procedures for the Phillips meter are described. Measured oxidation efficiencies are compared for analyses of COD, TOD, and 5-day BOD. The TOD meter is recommended for monitoring plant influents to municipal sewage treatment plants and for treating industrial waste waters. (Schulz-FIRL)

W77-12416

A SURVEY OF COMMERCIALLY AVAILABLE AUTOMATIC WASTEWATER SAMPLERS.
Environmental Monitoring and Support Lab., Cincinnati, Ohio.

R. P. Lauch.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 908. Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/4-76-051, September 1976. 38 p, 1 tab, 16 ref.

Descriptors: *Sampling, *Water sampling, *Design data, *On-site data collections, *Automation, Electronic equipment, Instrumentation, Monitoring, Waste water treatment, Pollutant identification.

Identifiers: Waste water samplers, Equipment manufacturers.

A survey of commercially available automatic waste water samplers is presented. Data presented in tabular form include manufacturer name and location, approximate cost, dimensions and weight, sample bottles, cooling type, materials exposed to samples, velocity in sample line, maximum lift, intake internal diameter, type of pump, controls, and power requirements. Short descriptions of available equipment are provided in an alphabetical listing of manufacturers. (Schulz-FIRL)

W77-12481

NEW MICROBIAL INDICATORS OF DISINFECTION EFFICIENCY.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

R. S. Engelbrecht, B. F. Severin, M. T. Masarik, S. Farooq, and S. H. Lee.

Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-030 547. Price codes: A05 in paper copy, A01 in microfiche. Report AD/A-030 547, July 1975. 88 p, 24 fig, 9 tab, 18 ref, 1 append.

Descriptors: Microorganisms, *Disinfection, *Yeasts, *Acid bacteria, *Chlorination, *Ozone, *Bioindicators, Quality control, *Pollutant identification, Microbiology, Waste water treatment, Sewage treatment, Municipal wastes, Coliforms, Enteric bacteria.

Identifiers: *Microbial indicators.

This study attempts to define a valid indicator organism for disinfection efficiency and to establish reliable enumeration techniques. Densities of acid-fast organisms, yeasts, and fecal coliforms were examined in raw and treated waste water from the East Side Waste Water Treatment Plant of the Urbana-Champaign Sanitary District, Illinois. Raw waste water was observed to contain on the average 5,000,000 fecal coliforms, 50,000 acid-fast organisms, and 50,000 yeasts per ml. Trickling filtration and activated sludge treatment reduced fecal coliforms to 2,100,000 and 360,000, respectively; acid-fast organisms to 3,200 and 1,700; and yeasts to 15,000 and 5,200. Acid-fast organism, yeast, and fecal coliform densities were reduced by 0.5, 3.0, and 6.0 logs, respectively, during full scale chlorination. Four yeasts (*Candida parapsilosis*, *C. krusei*, *Trichosporon fermentans*, and *Rhodotorula rubra*) and three acid-fast organisms (*Mycobacterium fortuitum*, *M. plei*, and *M. smegmatis*) were identified in municipal wastes. Tests on organism resistance to free chlorine using mixed cultures at pH 6, 7, and 10, and at 5°C and 20°C indicated that relative resistivities were acid-fast organisms > yeasts > poliovirus > *Salmonella typhimurium* > *E. coli*. Tests on ozone disinfection indicated that *E. coli* was less resistant than *C. parapsilosis* and that the degree of inactivation was greatly affected by the initial yeast density in the feed solution. Enumeration techniques and experimental methods are described. (Schulz-FIRL)

W77-12483

QUALITY OF URBAN FREEWAY STORM WATER.

Wisconsin Dept. of Transportation, Madison. Div. of Highways.

For primary bibliographic entry see Field 5B.

W77-12500

METEOROLOGICAL REGIMES FOR THE CLASSIFICATION OF AEROSPACE AIR QUALITY PREDICTIONS FOR NASA-KENNEDY SPACE CENTER.

National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center.

J. B. Stephens, and J. C. Sloan.

Available from the National Technical Information Service, Springfield, VA 22161 as N77-11570. Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum X-3450, October 1976. 13 p, 2 fig, 6 ref.

Descriptors: *Air pollution, *Air circulation, *Model studies, *Florida, Winds, Weather, Circulation, Diffusion, Climatology, Meteorology, Mathematical models, Atmosphere, *Pollutant identification.

Identifiers: Atmospheric diffusion, Aerospace environmental studies, Multilayer diffusion models, Rocket exhaust.

This report defined a procedure for developing a statistical air quality assessment for the launch of an aerospace vehicle from the Kennedy Space Center in terms of existing climatological data sets. The procedure can be defined as developing meteorological conditions identified for use with the NASA-Marshall Space Flight Center Rocket Exhaust Effluent Diffusion (REED) description. Fundamentally, this procedure involves the use of classical climatological regimes for the long-range analysis that can be narrowed as the synoptic and mesoscale structure is identified. Only broad synoptic regimes are identified at this stage of analysis. However, as the statistical data matrix is developed, these synoptic regimes will be refined in terms of the resulting eigenvectors as applicable to aerospace air quality predictions. (Sims-ISWS)

W77-12542

THE GEOCHEMISTRY OF MANGANESE, IRON, URANIUM, LEAD-210, AND MAJOR IONS IN THE SUSQUEHANNA RIVER.

Yale Univ., New Haven, Conn. Graduate School.

For primary bibliographic entry see Field 2K.

W77-12544

ANALYSIS OF VARIATIONS IN OCEAN COLOR.

Laboratoire de Physique et Chimie Marines, Villefranche-sur-Mer (France). Station Marine.

For primary bibliographic entry see Field 2K.

W77-12557

AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR U.S. COAST GUARD AIRCRAFT POLLUTION PATROLS.
Naval Postgraduate School, Monterey, Calif.

J. H. Heinz.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A021 785. Price codes: A07 in paper copy, A01 in microfiche. Master's Thesis, December 1975. 144 p, 39 fig, 20 tab, 17 ref, 8 append.

Descriptors: *Pollutant identification, *Water pollution, *Monitoring, *Oil spills, *Aircraft, Water pollution sources, Data processing, Management, Pollutants, Oil, Coasts, Oceans, Harbors, Estuaries, Oil pollution, Remote sensing.

Identifiers: Pollution patrols, Pollution reporting systems.

The purpose of this thesis is to examine the present data collected and to evaluate its usage in respect to pollution detection by Coast Guard aircraft patrols. It was found that, in general, more detailed and specific information is needed about the patrols. A system for collecting this new data and linking it to the present Pollution Incident Reporting System data base is proposed. The proposed system would allow evaluation of patrols at more specific areas and levels instead of the present district, coast and nationwide levels. Policy decisions could then be more specifically oriented to an area and/or the individual air station. (Sims-ISWS)

W77-12562

DISTRIBUTION OF MANGANESE, NICKEL, ZINC, CADMIUM, AND ARSENIC IN SEDIMENTS AND IN THE STANDARD ELUTRIATE.
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.

J. M. Brannon, R. M. Engler, J. R. Rose, P. G. Hunt, and I. Smith.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 355. Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper D-76-18, June 1976. 39 p, 9 fig, 2 tab, 45 ref, append.

Descriptors: *Arsenic compounds, *Cadmium, *Manganese, *Water pollution sources, *Dredging, Sediments, Bottom sampling, Separation techniques, Trace elements, Analytical techniques, Chemical properties, Water quality, Nickel, Zinc, Channel improvement, Desilting, Chemical analysis.

Identifiers: *Dredged material disposal, *Manganese compounds, *Cadmium compounds, Elutriate tests, Estuarine sediments, Trace metals, Benthic organisms, Marine sediments, Nickel compounds, Zinc compounds.

Sequential, selective chemical extraction was used to separate estuarine (Mobile Bay, Alabama), freshwater (Ashtabula, Ohio), and marine (Bridgeport, Connecticut) sediments into fractions (1) dissolved in sediment interstitial water; (2) adsorbed on mineral surfaces; (3) associated with hydrous iron and manganese oxides and hydroxides; (4) associated with sediment organic matter and sulfides; and (5) bound within the lattice of crystalline minerals and the interlayer positions of phyllosilicate (clay) minerals. Separate sediment extractions using the Elutriate test also were conducted. Manganese, nickel, cadmium, zinc, and arsenic concentrations were highest in fractions

Identification Of Pollutants—Group 5A

(5), (4), (4), and (3), respectively. Manganese concentration was highest in fraction (4) in sediments from Mobile Bay and Ashtabula and in fraction (5) in Bridgeport sediment. Manganese concentration determined in the standard elutriate was correlated with its concentration in sediment fraction (1), (2), and (3). Zinc concentration determined in the standard elutriate was correlated with its concentration in sediment fractions (3) and (4). However, nickel, cadmium, and arsenic concentrations were not correlated with their respective concentrations in any sediment fraction when all data were considered, although some site-specific correlations were noted for arsenic and nickel. (Henley-ISWS) W77-12574

HYDROCHEMICAL CONDITIONS OF THE DNIPIER IN THE REGION OF THE TRIPOL'YE STATE REGIONAL ELECTRIC POWER STATION, (IN RUSSIAN). Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. For primary bibliographic entry see Field 5B. W77-12613

THE ROLE OF DISPERSION IN FUEL OIL BIOASSAY. Battelle Pacific Northwest Labs., Richland, Wash. Marine Research Lab.; and Battelle-Seattle Research Center, Wash. J. R. Vanderhorst, C. I. Gibson, and L. J. Moore. Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 1, p. 93-100, 1976. 1 fig, 4 tab, 12 ref.

Descriptors: *Fuels, *Bioassay, *Shrimp, *Oil wastes, *Analytical techniques, *Dispersion, Crustaceans, Chemical properties, Mortality, Environmental effects, Mode of action, Aquaria, Chemistry, Circulation, Water pollution, Pollutant identification. Identifiers: No. 2 fuel oil.

Mortality of coon stripe shrimp (*Pandalus danae*) was investigated in flowing water aquarium systems receiving measured 'spills' of fuel oil with differing methods of seawater delivery and analytical characterization. The results obtained presented a data base for discussion of the influence of seawater delivery methods and dispersion of bioassay systems. The measuring of aqueous phase concentrations of No. 2 fuel oil and the mortality of shrimp when three different methods of oil-seawater contact were used were discussed. (Katz) W77-12643

METHOD AND APPARATUS FOR COLLECTING FLUID CONTAMINANTS. Magnavox Co., Fort Wayne. (Assignee). O. G. Nuxhall, and D. T. Carlton. U.S. Patent No 4,020,676, 13 p, 7 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 64, May 3, 1977.

Descriptors: *Patents, *Sampling, *Wastes, *Analysis, *Metals, Water pollution sources, Water pollution. Identifiers: Collection, Concentration.

An apparatus to collect and present contaminants from a known volume of fluid has a first container to receive a known volume of fluid, a contaminant trapping material, and a second container. A reversible drive moves the first container and the second container together thereby holding the contaminant trapping material in between the two containers. A vacuum generator is used to create a vacuum in the second container. The fluid from the second container is recirculated back to the first container to allow the fluid to pass through the trapping material a predetermined number of times to extract additional contaminants. Finally the sample of fluid is emptied into the first container and a vacuum is generated in the second

container so that the fluid will flow from the first container to the second container through the trapping material. The portion of contaminant trapping material containing the collected sample is then separated from the remainder of the material which allows the collected sample to be presented for analysis. (Sinha-OEIS) W77-12686

QUALITY MONITORING OF IRRIGATION WATER AND RETURN FLOWS IRRIGATION SEASON 1974. Max C. Fleischmann Coll. of Agriculture, Reno, Nev. For primary bibliographic entry see Field 5B. W77-12725

PROBLEMS IN PREDICTING AND MEASURING SOLUTE CONCENTRATIONS IN IRRIGATED FIELDS. California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. W. A. Jury, H. Fluhler, and L. H. Stolzy. In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 246-263. 11 fig, 4 tab, 5 ref.

Descriptors: *Salinity, Salts, Root zone, Irrigation practices, Simulation analysis, Model studies, *Solute, Measurement, Forecasting. Identifiers: *Salt transport (Soils).

The observed variation in salt concentration found between sensors at comparable depths has been shown to be influenced far more by variability in the water uptake distribution than by changes in the assumed conductivity of the soil or by input variations. This places severe restrictions on simulation of water and salt movement within the root zone. At the same time, however, it suggests that calculation of material transport below the root zone may not be as severely limited by uncertainty in the soil transport coefficients as had previously been suggested, provided that one can obtain reliable estimates of input water volumes and plant and soil evaporation. Finally, the period of transition between new and old irrigation management can be quite long, during which time reliance on soil sensors to provide feedback for irrigation levels is likely to cause great errors. (See also W77-12726) (Skogerboe-Colorado State) W77-12749

PROCEEDINGS OF A CONFERENCE ON EMERGING ENVIRONMENTAL PROBLEMS: ACID PRECIPITATION. Environmental Protection Agency, New York. Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 148. Price codes: A06 in paper copy, A01 in microfiche. Proceedings of a conference held May 19-20, 1975, The Institute on Man and Science, Rensselaerville, New York. Report No. EPA-902/9-75-001, November 1975. 118 p.

Descriptors: *Acids, *Precipitation (Atmospheric), *Ecology, *Public health, Rainfall, Snowfall, Surface water, Sampling, Surveys, Water pollution effects, Air pollution effects, Chemicals, Chemistry, Pollutants, Water pollution, Air pollution, Toxicity. Identifiers: *Acid precipitation.

Nine papers were presented on the long-term ecological and health problems associated with the increase in acidity of precipitation in recent years. The papers described the spatial distribution of acid precipitation, the ecological effects of acid precipitation, and the health effects of acid aerosols. Several studies of the mentioned problems were described. (See W77-12810 thru W77-12813) (Sims-ISWS) W77-12809

ACID PRECIPITATION: A WORLD CONCERN. Kungliga Lantbrukshogskolan, Uppsala (Sweden). Dept. of Soil Science; and Kungliga Lantbrukshogskolan, Uppsala (Sweden). Div. of Ecochemistry. S. Oden.

In: Proceedings of a Conference on Emerging Environmental Problems: Acid Precipitation; Report No. EPA-902/9-75-001. Conference held May 19-20, 1975, The Institute on Man and Science, Rensselaerville, New York, p 5-44, November 1975. 20 fig, 3 ref.

Descriptors: *Acids, *Precipitation (Atmospheric), Europe, Networks, Sampling, Surface waters, Rainfall, Snow, Nitrates, Ammonia, Hydrogen ion concentration, Sulfur, Chemistry, Effects, Vegetation, Air pollution, Pollutants, Surveys. Identifiers: *Acid precipitation, *Sweden, Nitrogen ion concentration.

The increasing acidity of air precipitation in Europe and its consequences to soils, vegetation, and surface waters were first mentioned in a Swedish Governmental Report published in 1967. The basic facts in the report originated from long-term network data regarding the chemistry of air and precipitation in Europe and, to some extent, of surface waters in Scandinavia. At the time of the report, the records extended for almost a 10-year period for certain areas in Europe. When plotting the data for the different elements at individual stations, it became evident that certain elements showed either a positive or a negative trend with respect to time. The chemical climate obviously was changing in Europe. In order to study the effect on soils and surface waters (and indirectly on vegetation), a surface water network was set up in Scandinavia in 1961-62. This presentation was based mainly on data from the two above mentioned network systems. (See also W77-12809) (Sims-ISWS) W77-12810

ACID PRECIPITATION: OUR UNDERSTANDING OF THE PHENOMENON. New York Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section. G. E. Likens.

In: Proceedings of a Conference on Emerging Environmental Problems: Acid Precipitation; Report No. EPA-902/9-75-001. Conference held May 19-20, 1975, The Institute on Man and Science, Rensselaerville, New York, p 45-75, November 1975. 12 fig, 4 tab, 19 ref.

Descriptors: *Acids, *Precipitation (Atmospheric), *United States, Rainfall, Snowfall, Surface waters, Sampling, Data processing, Nitrates, Sulfur, Surveys, Chemistry, Hydrogen ion concentration, Pollutants, Air pollution, Water pollution sources. Identifiers: *Acid precipitation, Nitrogen ion concentration.

In the northeastern United States, rain and snow are currently at pH's much lower than 5.6, i.e., precipitation is several hundred times more acidic than would be expected. Values of pH less than 3.0 were measured for individual rainstorms in the northeastern U.S. The lower pH's are brought about by the presence of strong acids, sulfuric and nitric, in rain and snow. The changes in acid precipitation in the U.S. were calculated from chemical analyses of rainfall samples. It was shown that acidity has been increasing in the Northeast U.S. and, to a lesser extent, in all the U.S. east of the Mississippi River. (See also W77-12809) (Sims-ISWS) W77-12811

ACID PRECIPITATION: OUR UNDERSTANDING OF THE ECOLOGICAL EFFECTS. Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources. C. L. Schofield.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

In: Proceedings of a Conference on Emerging Environmental Problems: Acid Precipitation; Report No. EPA-902/9-75-001. Conference held May 19-20, 1975, The Institute on Man and Science, Rensselaerville, New York, p 76-87, November 1975. 6 ref.

Descriptors: *Acids, *Precipitation (Atmospheric), *Ecology, Ecosystems, Surface waters, Lakes, Fish, Aquatic life, Rainfall, Snowfall, Snowmelt, Atmosphere, Air pollution, Pollutants, Chemistry, Sulfur, Nitrates, Environmental effects. Identifiers: *Acid precipitation, *Ecological effects.

Significant alterations have been recognized in aquatic and terrestrial ecosystems. The alterations appear to have been induced by changes in atmospheric chemistry. However, the extent and magnitude of the effect of the alterations of ecosystems are not adequately understood, nor have they been thoroughly assessed. Acute effects of acid precipitation on soils and vegetation have been clearly identified only under extreme conditions, either experimentally induced or in situations very close to sources of heavy air pollution. The most serious consequence of regional acidification at currently observed levels may be the increased rate of leaching of major elements and trace metals from forest soils and vegetation. This is true both for the forest ecosystem and for the aquatic systems receiving these effluents. Precipitation currently falling on remote areas in the northeastern United States, Scandinavia, and parts of Europe, is an acutely toxic medium to fish and other aquatic organisms. The average concentrations of strong acids and heavy metals found in precipitation from these areas greatly exceeds the known tolerance levels of many organisms inhabiting the lakes and streams in these regions. At the present time, our understanding of the ecological effects of lake and stream acidification is primarily descriptive in nature. Intensive lake studies and carefully designed monitoring programs will be required to enhance our understanding of the acidification process. (See also W77-12809) (Sims-ISWS) W77-12812

HEALTH EFFECTS OF ACID AEROSOLS, National Environmental Research Center, Research Triangle Park.

J. G. French.

In: Proceedings of a Conference on Emerging Environmental Problems: Acid Precipitation; Report No. EPA-902/9-75-001. Conference held May 19-20, 1975, The Institute on Man and Science, Rensselaerville, New York, p 88-95, November 1975. 14 ref.

Descriptors: *Air pollution, *Aerosols, *Acids, *Public health, Pollutants, Sulfur compounds, Nitrogen compounds, Laboratory tests, On-site investigations, Chemicals, Effects, Toxicity, Air environment, Effluents, Air pollution effects. Identifiers: Health effects.

The major research effort in the study of adverse health effects of air pollutants in the past has centered around the primary pollutant such as sulfur dioxide (SO₂) and nitrogen dioxide (NO₂). It is realized now that the transformation products may be more toxic than the primary pollutants themselves. Recent reports emanating from epidemiologic studies carried out as part of the Community Health and Environmental Surveillance System of EPA indicate that the levels of suspended sulfates associated with certain adverse health effects were lower than the levels of SO₂ and total suspended particulates (TSP) associated with the same health effect. (See also W77-12809) (Sims-ISWS) W77-12813

CONCEPT AND DESIGN: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, Skidaway Inst. of Oceanography, Savannah, Ga.

D. W. Menzel, and J. Case.

Bulletin of Marine Science, Vol. 27, No. 1, p 1-7, 1977. 2 fig, 9 ref.

Descriptors: Research and development, *Research equipment, *Design, Model studies, Laboratory tests, Ecosystems, Toxicity, Toxins, Technology, Aquatic life, Water pollution, Research facilities, Planning, *Methodology, Pollutant identification. Identifiers: Controlled Ecosystem Pollution Experiment.

The conceptual framework within which the Controlled Ecosystem Pollution Experiment (CEPEX) was designed and implemented and a description of the physical facility within which the experiments were conducted were presented. The program involved a cooperative, multi-disciplinary research effort designed to test the effects of chronic exposure to low levels of pollutants on pelagic marine organisms. (Klein) W77-12854

TOXICITY TESTS ON THE COMBINED EFFECTS OF CHLORINE AND TEMPERATURE ON RAINBOW (SALMO GAIRDNER) AND BROOK (SALVELINUS FONTINALIS) TROUT, Battelle-Northwest, Richland, Wash.

E. G. Wolf, M. J. Schneider, K. O. Schwarzmiller, and T. O. Thatcher.

Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-SA-5349, Price codes: A02 in paper copy, A01 in microfiche. BNWL SA 5349, 18 p, 1975. 5 fig, 15 ref.

Descriptors: *Toxicity, *Water temperature, *Chlorine, *Rainbow trout, *Brook trout, *Salmonids, *Trout, Water quality, Lethal limit, Resistance, Mortality, Bioassay, Thermal stress, Mode of action, Laboratory tests, Environmental effects. Identifiers: *Synergistic effects.

Combined effects of thermal stress and chlorine are demonstrated utilizing 96 h TL₅₀ flow through toxicity tests. These data illustrated that the combined interaction became evident only after rainbow trout acclimated at 5, 10, 15, and 20°C were tested simultaneously at specific test temperatures. It was also determined that the rainbow trout must experience thermal stress greater than 10°C before the combined effect can be noted. Fish size especially for brook trout influenced sensitivity more than combined interaction of chlorine and thermal shock. Brook trout larger than 89 mm were significantly less vulnerable to chlorine-temperature toxicity than the smaller fish. Concepts also discussed are the compatibility of findings concerning latent mortality, the primary site of chlorine toxicity and the reliability of short term, high dose tests that have recently appeared in the literature. (Klein) W77-12861

UPPER BAY SURVEY, VOL. II. TECHNICAL REPORT, Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.

T. O. Munson, D. K. Ela, and C. Rutledge, Jr. Final Report to Maryland Department of Natural Resources, Vol. 2, 126 p, 1976. 100 fig, 63 tab, 87 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Organic compounds, *Polychlorinated biphenyls, *Bays, *Chesapeake Bay, Path of pollutants, Ecosystems, Sediments, Zooplankton, Shellfish, Toxins, Water pollution sources, Water quality, Oysters, *DDT, Estuaries, Estuarine environment. Identifiers: Clams, Technical report, PCB, *Chlordane, Baltimore Harbor, *DDT residues, Susquehanna River.

A one-year field sampling and experimentation program was undertaken in the upper Chesapeake Bay as part of an interdisciplinary evaluation of the mechanisms, rates, and routes of chlorinated hydrocarbon transports through aquatic biota. The biota investigated included zooplankton and sessile benthic shellfish including clams (*Mya arenaria*), oysters (*Crassostrea virginica*), and brackish water clams (*Rangia cuneata*). The microbiology of suspended particulates, bottom sediments, and water was examined. Analyses of both suspended and bottom sediments recovered support that the finer grain-sizes carry the highest concentrations of chlorinated hydrocarbons. Hydrobiological aspects of the study were focused on the assessment of the sources and transport mechanisms of the CHC's and PCB's in the bay. (Klein) W77-12880

UPPER BAY SURVEY, VOL. III. AUTOMATED DATA PROCESSING AND SUPPLEMENTARY DATA, Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.

T. O. Munson, D. K. Ela, and C. Rutledge, Jr. Final Report to Maryland Department of Natural Resources, Vol. 3, 180 p, 1976. 4 fig, 27 tab, 3 appendices.

Descriptors: *Sampling, *Bays, *Chesapeake Bay, *Data collections, *Data processing, *Data storage and retrieval, Data transmission, Basic data collections, Information retrieval, Documentation, Technical writing, Computers, Information exchange, Suspended solids, Plankton, Water quality, Estuaries, Estuarine environment, *Polychlorinated biphenyls, On-site investigation. Identifiers: Upper Chesapeake Bay.

The Upper Bay (Chesapeake Bay) Data Base System proved to be a useful and efficient tool for managing, analyzing, and presenting the many kinds of data collected. The Upper Bay Survey's prime purpose was to provide information and data to support responsible public officials in the decisions they must make and to assist them in managing Maryland's natural resources in the Chesapeake Bay. Particularly, the project was intended to relate the general sources, distribution and concentrations of pesticides, polychlorinated biphenyls, and bacteria. Some insight into the uptake and toxicity in shellfish for these pollutants was also attempted. To expedite the fulfillment of this purpose and to provide for effective control of the data for the project's own scientists, a task was defined for the management of automated data operations. The objectives of this task included (1) planning, designing, and operating the data system; (2) coordinating and conducting the collection and assembly of data for the computers; (3) providing for storage and rapid retrieval of data for study participants; and (4) providing computer correlation analysis to the best practicable extent. Included are supplementary data on hydrology, meteorology, suspended sediments, and marine biology data on water quality at plankton sampling stations. (Klein) W77-12881

CRITERIA DOCUMENT FOR PCB'S, Massachusetts Audubon Society, Lincoln. I. C. T. Nisbet.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 397, Price codes: A99 in paper copy, A01 in microfiche. Report EPA-440/9-76-021, 297 p, 1976. 37 fig, 45 tab, 417 ref.

Descriptors: Fish reproduction, Birds, Domestic animals, Biochemistry, *Reviews, *Bibliographies, *Organic compounds, *Polychlorinated biphenyls, *Physicochemical properties, *Toxicity, *Path of pollutants, Water pollution sources, Water pollution effects, Mode of action, Water quality, Aquatic life, Aroclors,

Chemical degradation, Chemical properties, Estuarine environment, Fresh water, Phytoplankton, Aquatic environment, Animal pathology. Identifiers: *Bioaccumulation, Tissue analysis, Marine invertebrate community, Sublethal effects of fish, Domestic fowls, Liven, Environmental fate.

This document summarized the physical/chemical properties, toxicological information and environmental fate and effects of PCB's with emphasis on its aquatic behavior. Reviews of the literature included data from laboratory tests and on-site investigations. (Klein)
W77-12882

POLYCHLORINATED BIPHENYLS IN NATURAL WATERS AND THEIR BIOLOGICAL DANGER, (IN RUSSIAN), Akademiya Nauk USSR, Kiev. Inst. of Colloidal Chemistry and Water. V. F. Demchenko, M. A. Klisenko, V. I. Kofanov, and F. Ya. Komarovskii. *Gidrobiol Zh* 12(4), p 118-130, 1976.

Descriptors: *Polychlorinated biphenyls, Reviews, Toxicity, Natural waters, Water pollution effects, Pesticide residues, Microorganisms.

Numerous studies on polychlorinated biphenyls are reviewed. Topics discussed include the properties, production and uses of polychlorinated biphenyls, their distribution throughout the environment and in plants, animals and microorganisms, particularly marine species, their toxicity and toxic effects, and methods of their determination, both alone and in the presence of organochlorine pesticides.—Copyright 1977, Biological Abstracts, Inc.
W77-12967

THE TRACE ELEMENT COMPOSITION OF MINE WATERS, (IN RUSSIAN), Perm Gornyi Inst. (USSR). B. B. Nemkovski, and L. P. Oshchepkova. *Gig Sanit* 10, p 108-109, 1976.

Descriptors: *Trace elements, *Mine waters, Copper, Iron, Nickel, Zinc, Cadmium, Antimony, *Metals, Heavy metals, *Pollutant identification. Identifiers: USSR.

The level of 26 different trace elements was studied in the waters of 57 coal mines in different locations in the USSR. The levels of a number of elements exceeded maximum permissible concentrations: Fe, Be, Ni, Zn and Cu in the Kizel Basin, Fe and Zn in the Chelyabinsk oblast, Fe, Cu, Zn, Sr and Cd in the Kuzbas and Fe, Cu and Sr in the Donbas. Other trace elements were also detected, including those for which no maximum permissible concentrations were established. The mine waters had a higher average level of trace elements than did underground waters in the same location. The mine waters are thus a source of surface water pollution.—Copyright 1977, Biological Abstracts, Inc.
W77-12969

THIN-LAYER CHROMATOGRAPHIC DETERMINATION OF CADMIUM IN WATER AND BIOLOGICAL MEDIA, (IN RUSSIAN), Vsesoyuznyi Nauchno-Issledovatel'skii Institut Gigieny i Toksikologii Pestitsidov, Kiev (USSR). S. E. Kataeva. *Gig Sanit* 10, p 60-61, 1976.

Descriptors: *Cadmium, Metals, *Chromatography, *Pollutant identification, *Methodology, Analytical techniques. Identifiers: *Polyvinylchloride.

A method was developed for determining Cd in water and in biological media (blood, urine, organs) in studies of polyvinylchloride materials sta-

bilized with Cd compounds. The method is based on the chloroform extraction of a complex compound of Cd with sodium diethyldithiocarbamate and subsequent separation of Cd in a thin layer of silica gel. Other metals (Pb, Sn, Zn) often present in aqueous extracts of polyvinylchloride materials do not interfere with Cd determination by the described method. The sensitivity of the method is 0.01 ug in 11. —Copyright 1977, Biological Abstracts, Inc.
W77-12970

HEAVY-METAL POLLUTION OF ELBE RIVER SEDIMENTS, (IN GERMAN), Kiel Univ. (West Germany). Institut fuer Pflanzenernahrung und Bodenkunde. R. Lichtfuss, and G. Bruemmer. *Naturwissenschaften* 64(3), p 122-125, 1977.

Descriptors: *Heavy metals, *Sediments, Water pollution, Rivers, Zinc, Copper, Mercury, Lead, Cadmium, Chromium. Identifiers: *West Germany(Elbe River), Hamburg.

Sediments of the river Elbe (West Germany), especially in the port of Hamburg and upstream from the town, are highly polluted with the heavy metals, Zn, Cu, Cr, Pb, As, Cd, and Hg. From Hamburg to the mouth of the river the heavy-metal content decreases rapidly as a result of a mixing process of polluted fluvial sediments with scarcely polluted marine sediments. Compared with Rhine sediments, the sediments of the Elbe show higher contents of Zn, Cu, As, and Hg, and lower contents of Cr, Pb, and Cd. —Copyright 1977, Biological Abstracts, Inc.
W77-12978

AN EXPRESS METHOD FOR ESTABLISHING MINIMUM PERMISSIBLE CONCENTRATIONS FOR WATERS USED FOR COMMERCIAL FISHING, (IN RUSSIAN), Moscow State Univ. (USSR). N. S. Stroganov. *Zh* 12(4), p 100-103, 1976.

Descriptors: *Lethal limit, *Methodology, Commercial fishing, Daphnia, *Toxicity, *Water quality standards, *Pollution identification.

An express method for determining minimum permissible concentrations of toxic substances in waters used for commercial fishing is described. The method is based on *Daphnia magna* survival and fertility indices. The preliminary minimum permissible concentration of a toxic substance is that concentration at which the *D. magna* survival rate and real fertility do not decrease by more than 25% in comparison with controls. Stimulation of real fertility and a lengthening of the life span is viewed as a positive manifestation of the action of a toxic substance. —Copyright 1977, Biological Abstracts, Inc.
W77-12979

STUDIES ON COASTAL OCEANOGRAPHY IN TANOURA BAY, IZU PENINSULA (1975-1974), (IN JAPANESE), Nihon Univ., Tokyo. Coll. of Agriculture and Veterinary Science. For primary bibliographic entry see Field 5B.
W77-12980

5B. Sources Of Pollution

NITROGEN RECYCLING IN THE CHOWAN RIVER, North Carolina State Univ. at Raleigh. Dept. of Zoology. For primary bibliographic entry see Field 5C.
W77-12252

THE DISTRIBUTION OF TOXIC METALS IN MARINE ECOSYSTEMS AS A RESULT OF SEWAGE DISPOSAL AND NATURAL PROCESSES, Duke Univ., Beaufort, N.C. Marine Lab. P. J. Whaling, R. T. Barber, and J. C. Paul. Available from: the National Technical Information Service, Springfield, VA 22161 as PB-272 644. Price codes: A07 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, UNC-WRRRI Rpt. No. 123, March 1977. 132 p, 61 fig, 57 tab, 40 ref. OWRT B-071-NC(2), 14-31-0001-4115.

Descriptors: *Metals, *Sewage disposal, Wastes, *Mercury, Sewage treatment, Ecosystems, *North Carolina, Estuaries, Food supplies, *Path of pollutants, Water pollution effects, Waste disposal. Identifiers: *Toxic metals, Marine ecosystems.

Industrial discharge of wastes containing high concentrations of mercury and other toxic metals has largely been abated by strong federal and state regulation. The recovery of the polluted ecological systems is taking longer. Sewage treatment is a necessary part of our way of life and in addition, the natural accumulation of threatening levels of mercury and cadmium in unpolluted marine food chains is an aspect of environmental concern that must be understood to protect human health. The role of sewage disposal and natural food chain processes in the distribution of toxic metals in marine ecosystems was examined in several small eastern North Carolina estuaries receiving different inputs. On the basis of metal distribution, estuaries receiving treated sewage effluent were clearly distinguishable from those not receiving this discharge. The magnitude and spatial extent of the elevated toxic metal distributions was very limited in both sediments and organisms. While some organisms did not have elevated metal concentrations, the economically important oysters did not, nor did the marsh grass, *Spartina alterniflora*. The large and consistent variation in the amount of mercury and other trace metals discharged to the surrounding estuaries by various eastern North Carolina towns was traced to variations in the metal content of inflow to the plant and not to operational variations between the plants. It was not possible to account for the origin of the metal variations in wastewaters of these small towns which have no known commercial activities using these metals. (Kiger-NC State)
W77-12253

METALS IN THE WATER, SEDIMENTS AND BIOTA OF THE HAW AND NEW HOPE RIVERS, NORTH CAROLINA, North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering. For primary bibliographic entry see Field 5A.
W77-12254

AN INDEX FOR PREDICTING SURFACE WATER QUALITY BASED ON THE VEGETATION OF THE WATERSHED, Arizona Univ., Tucson. Dept. of Ecology and Evolutionary Biology. For primary bibliographic entry see Field 5A.
W77-12262

COMPLETION REPORT ON CONTRIBUTION OF FERTILIZERS TO WATER POLLUTION, Rutgers - The State Univ., New Brunswick, N. J. Dept. of Soils and Crops. L. A. Douglas, and E. L. Bouroudimos. Available from: the National Technical Information Service, Springfield, VA 22161 as PB-272 732. Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Water Resources Research Institute, Rutgers University, New Brunswick, N.J., July 1977. 8 p, 3 ref. OWRT A-027-NJ(8).

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

Descriptors: *Nitrates, *Nitrites, *Ammonia, *Phosphates, *Leaching, *Fertilizers, Land use, Denitrification, Water pollution sources, Path of pollutants.

Field studies were undertaken to determine the magnitude of leaching of fertilizer NO₃, NH₄, and PO₄. The effect of N-serve on these reactions was observed, and little effect on leaching was found because most leaching takes place during the fall and winter when precipitation exceeds evapotranspiration. No leaching of NH₄ and PO₄ was observed. The common fertilizer efficiency measure of N in crop/N applied in fertilizer may be used as an indication of the amount of fertilizer N that will be leached. Studies of nutrients in streams were undertaken to relate land use to NO₃, NH₄ and PO₄ concentrations in surface waters. Sewage treatment plants and 'illegal drains' were found to be major sources of all three ions. In order of decreasing contribution of NO₃: urban land contributes more than cropland which contributes more than woodlands. Urban lands, croplands and woodlands contribute equal amounts of NH₄ and PO₄ to streams. The 'background level' of PO₄ in central New Jersey streams is many times higher than the 0.01 ppm level often advocated. Although very high concentrations of NO₃ were found in the soil solution in the subsoil the concentration of NO₃ found in streams was rather low. Denitrification must be an active process in subsoils, and probably in the groundwater. Groundwater studies were also undertaken, but they were inconclusive. (Whipple-Rutgers)

W77-12264

A LABORATORY STUDY OF WASTE INJECTION INTO A GHYBENHERZBERG GROUND-WATER SYSTEM UNDER DYNAMIC CONDITIONS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 8B.
W77-12267

RELEASE AND SORPTION OF PHOSPHORUS BY SEDIMENTS IN A MOVING WATER-COURSE,
South Dakota School of Mines and Technology, Rapid City. Dept. of Civil Engineering.
L. L. Harms.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 715. Price codes: A05 in paper copy, A01 in microfiche. Prepared for South Dakota Water Resources Research Institute, Brookings, July 1977. 85 p, 19 fig, 5 tab, ref, 7 append. OWRT B-046-SDAK(1), 14-34-0001-6119.

Descriptors: *Sediments, *Phosphorus, *Sorption, Scour, Streams, Flow, *Water pollution sources, Bed load, Sediment load, Bed load samplers, *Phosphates, Path of pollutants.
Identifiers: *Nonpoint water pollution sources.

The objectives were to determine the role of streambed sediments with respect to increased phosphorus concentrations during high flow periods, and to identify the relative importance of point sources and nonpoint sources as phosphorus contributors. Core samples of streambed sediments were collected from a stream at points above and below a sewage treatment plant both before and after periods of high flow. Sediments were analyzed for total and organic phosphorus content. Water samples were collected both above and below the sewage treatment plant during normal and high flow conditions to characterize the phosphorus content of the stream. All water samples were analyzed for total phosphate, total filtrable phosphate, and filtrable orthophosphate. To identify the relative importance of point sources and nonpoint sources of phosphorus pollution, a comparison was made of those sediment and water samples collected above the treatment plant to

those collected below the plant. Streambed sediments play a major role with respect to increased phosphorus concentrations of streams during high flow periods. Those sediments subject to point sources of pollution are greater contributors of phosphorus than those sediments not subject to such pollution. Results demonstrate that high phosphorus concentrations found during increased flows are mostly the result of streambed scour and not of nonpoint source pollution. Evaluating the magnitude of nonpoint sources of phosphorus pollution based only on stream concentrations with out allowance for streambed sediment contributions erroneous. (Wiepma-S Dak State)

W77-12273

A NOTE ON THE LATERAL MIXING OF WATER MASSES,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 2L.
W77-12303

NUTRIENT TRANSPORT IN SURFACE RUNOFF AND INTERFLOW FROM AN ASPEN-BIRCH FOREST,
Agricultural Research Service, Morris, Minn. North Central Region.
D. R. Timmons, E. S. Verry, R. E. Burwell, and R. F. Holt.
Journal of Environmental Quality, Vol. 6, No. 2, p 188-192, April-June 1977. 1 fig, 3 tab, 18 ref.

Descriptors: Nitrogen, Phosphorus, *Nutrient removal, *Water chemistry, *Surface runoff, Nitrogen compounds, Fertilizers, Phosphates, Phosphorus compounds, Calcium, Magnesium, Sodium, Chemical oxygen demand, Water quality, Snowmelt, Runoff, Nutrients, Minnesota.
Identifiers: *Nutrient transport, *Aspen-birch forest, *Nitrogen losses, *Phosphorus losses, Forest ecosystems, Organic nitrogen.

Nutrients transported in surface runoff and interflow from an undisturbed aspen-birch forest (6.48 ha) in northern Minnesota were measured for 3 years. Surface runoff from snowmelt accounted for 97% of the average annual surface runoff and for 57% of the average annual water loss. Slope aspect influenced the amount, rate, and time of snowmelt runoff. In surface runoff, organic nitrogen (N) comprised 80% of the total N load, and organic (+ hydrolyzable) phosphorus (P) comprised 45% of the total P load. The quantities of cations in surface runoff were in the order of calcium (Ca) greater than potassium (K) greater than magnesium (Mg) greater than sodium (Na). More than 96% of all the nutrients in surface runoff were transported by snowmelt. The annual volumes of interflow varied only slightly during the 3 years. Compared with surface runoff, the amounts of all the nutrients (except Na) and their weighted concentrations decreased in interflow. The nutrient losses from the ecosystem can accumulate in surface waters. (Henley-ISWS)

W77-12306

THE CONTRIBUTION OF RED CLAY EROSION TO ORTHOPHOSPHATE LOADINGS INTO SOUTHWESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Chemistry.
D. A. Bahnick.
Journal of Environmental Quality, Vol. 6, No. 2, p 217-222, April-June 1977. 3 fig, 2 tab, 9 ref. EPA R005169-01.

Descriptors: *Phosphates, *Nutrients, *Phosphorus, *Bank erosion, *Lake Superior, Analytical techniques, Fertility, Soil analysis, Phosphorus compounds, Water pollution sources, Sorption, Particle size, Chemical properties, Clays, Soil chemistry, Physical properties, Soils, Erosion, Watersheds(Basins), Path of pollutants.
Identifiers: *Phosphate sorption, *Soil dissolution, *Orthophosphates, *Red clay erosion, River particulates, Soluble phosphate, Red clay.

The effects of the erosion of red clay deposits along the northwestern Wisconsin shoreline area on orthophosphate inputs into Lake Superior were investigated. Using clay soil and river particulate samples, the release of orthophosphate in Lake Superior water was studied. The results indicated a maximum release of 240 metric tons of soluble PO₄ from soil entering Lake Superior annually from shoreline erosion and 63 metric tons of PO₄ from river particulates. The estimates assume equilibrium with soluble orthophosphate at a concentration of less than 0.005 mg/liter of PO₄, which is typical of Lake Superior water. Actual PO₄ release may be less because soluble orthophosphate concentrations are higher in near shore waters. Suspended particulates buffer soluble orthophosphate concentrations and may even cause a net removal of orthophosphate from Lake Superior water when high concentrations exist. (Henley-ISWS)

W77-12307

EFFECTS OF SOIL, COVER CROP, AND NUTRIENT SOURCE ON MOVEMENT OF SOIL, WATER, AND NITROGEN UNDER SIMULATED RAIN-SLOPE CONDITIONS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 2B.
W77-12309

FLOWS OF SODIUM, POTASSIUM, MAGNESIUM AND CALCIUM IN THE R. CYNON, S. WALES,
University of Wales Inst. of Science and Technology, Cardiff (Wales). Dept. of Applied Biology.
B. D. Hughes, and R. W. Edwards.
Water Research, Vol. 11, No. 7, p 563-566, 1977. 3 fig, 4 tab, 15 ref.

Descriptors: *Calcium, *Magnesium, *Sodium, *Potassium, *River flow, Water quality, Streamflow, Geology, Watersheds(Basins), Water chemistry, Flow, Sodium compounds, Potassium compounds, Calcium compounds, Magnesium compounds, Analytical techniques, Chemical analysis, Foreign countries, Foreign research.
Identifiers: *South Wales, *Cynon River(Wales), *Wales.

The flows of Na, K, Mg and Ca are related to water flow at ten stations in the Cynon catchment. The elements behave very differently in their dependency on water flow and their concentration down the catchment. The cause of the differences is considered to be associated with the complex geology of the catchment enhanced by the pumping of underground water from the marine Coal Measures. Losses from the catchment were compared with precipitation inputs. (Henley-ISWS)

W77-12320

STREAM JUNCTIONS-A PROBABLE LOCATION FOR BEDROCK PLACERS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 2J.
W77-12322

BINARY GAS DIFFUSION OF METHANE-NITROGEN THROUGH POROUS SOLIDS,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2F.
W77-12323

MASS SPECTROMETRIC ANALYSIS OF PRODUCT WATER FROM COAL GASIFICATION,
Energy Research and Development Administration, Pittsburgh, Pa. Pittsburgh Energy Research Center.
For primary bibliographic entry see Field 5A.

W77-12328

PREDICTION OF LONGITUDINAL DISPERSION IN NATURAL STREAMS,

Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering. For primary bibliographic entry see Field 2E. W77-12330

FLUORESCENCE TRACING OF THE FLOW AND DISPERSION OF SULFITE WASTES IN A FJORD SYSTEM,

Goteborg Univ. (Sweden). Institutionen for Analytisk Kemi. B. Josefsson, and G. Nyquist. Ambio, Vol. 5, No. 4, p 183-187, 1976. 13 fig, 13 ref, 1 tab.

Descriptors: *Pulp wastes, *Fjords, *Fluorescence, Water pollution, Wastes, Industrial wastes, *Water pollution sources, Foreign countries, Europe, Humic acids, Tracking techniques, Pulp and paper industry, Effluents, Pollutant identification. Identifiers: *Lignosulfonates, Idefjord, Sweden, Norway.

Idefjord (on the border between Sweden and Norway) is heavily contaminated by effluents from a sulfite pulp mill located in the town of Halden. The spread of the mill effluent in Idefjord and in surrounding waters was studied. Fluorometric detection of lignosulfonates was used to follow the dispersion and flow direction of polluted water. Simultaneous with the analyses of lignosulfonates, the content of humic substances was determined. Using these data along with results from oxygen content measurements, it was possible to trace the spread of lignosulfonates far from the sources. When the sulfite mill is shut down, the lignosulfonate content in the fjord changes rapidly. An influence of lignin wastes water from north of the area under study was also recorded. Such tracing methods can be applied to other effluent compounds of ecological significance. (Speckhard-IPC) W77-12333

MATERIALS BALANCE AND POLLUTION LOAD -- EXAMPLE FROM THE PULP AND PAPER INDUSTRY (BILAN MATIERES ET FLUX DE POLLUTION -- EXEMPLE DE L'INDUSTRIE DE LA PATE A PAPIER),

Groupe Europeen de la Cellulose, Paris (France). P. Henri-Robert. Translation available (\$8) from Inst. of Paper Chemistry Appleton, Wis. 54911. Papier, Carton et Cellulose, Vol. 26, No. 3, p 60-63, March, 1977. 2 fig, 1 illus, 1 tab.

Descriptors: *Water pollution sources, *Pulp wastes, Organic loading, Sulfur compounds, Wastes, Industrial wastes, Organic compounds, Sulfur, Air pollution, Odor, Pulp and paper industry, Recycling. Identifiers: *Kraft mills, Chemical recovery, Mass balance (Materials balance).

The case of a bleached kraft pulp mill is taken as an example for examining the relationship between raw materials used, recycling, and pollution load in industrial plants. The various phases of bleached kraft pulp manufacture (cooking, washing, bleaching, pulp drying, and liquor recovery and chemical regeneration) are outlined, and a materials balance chart is developed for the process. A bleached kraft pulp mill is shown to attain a recycling of raw wood material approaching 95%. However, the loss of organic material though relatively low, is responsible for a significant amount of water pollution. Sulfur recovery approximates 70% and the remainder is responsible for air pollution and odor problems. (Speckhard-IPC) W77-12345

USE OF PYROLYSIS/GAS-CHROMATOGRAPHY IN ANALYZING LOW-VOLATILITY ORGANIC WATER POLLUTANTS (DIE ANWENDUNG DER PYROLYSE-GASCHROMATOGRAPHIE ZUR ANALYTIK VON SCHWERLUECHTIGEN ORGANISCHEN WASSERINHALTSSTOFFEN), Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie. For primary bibliographic entry see Field 5A. W77-12363

STORAGE OF TREATED SEWAGE EFFLUENT AND STORM WATER IN A SALINE AQUIFER, PINELLAS PENINSULA, FLORIDA, Geological Survey, Tampa, Fla. Water Resources Div. For primary bibliographic entry see Field 5E. W77-12377

DERIVATION OF EQUATIONS DESCRIBING SOLUTE TRANSPORT IN GROUND WATER,

Geological Survey, Denver, Colo. Water Resources Div. L. F. Konikow, and D. B. Grove. Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 874/AS. Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-19, April 1977. 30 p, 2 fig, 19 ref.

Descriptors: *Model studies, *Equations, *Computer models, *Groundwater movement, *Path of pollutants, Dispersion, Analytical techniques. Identifiers: *Solute-transport models.

A general equation describing the three-dimensional transport and dispersion of a reacting solute in flowing ground water is derived from the principle of conservation of mass. The derivation presented is more detailed but less rigorous than derivations published previously. The general solute-transport equation relates concentration changes to hydrodynamic dispersion, convective transport, fluid sources and sinks, and chemical reactions. Because both dispersion and convective transport depend on the velocity of ground-water flow, the solute-transport equation must be solved in conjunction with the ground-water flow equation. (Woodard-USGS) W77-12381

GROUND-WATER QUALITY NEAR A SEWAGE-SLUDGE RECYCLING SITE AND A LANDFILL NEAR DENVER, COLORADO,

Geological Survey, Lakewood, Colo. Water Resources Div. S. G. Robson. Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 294/AS. Price codes: A08 in paper copy, A01 in microfiche. Water-Resources Investigations 76-132, May 1977. 137 p, 6 fig, 2 plates, 7 tab, 7 ref.

Descriptors: *Water pollution sources, *Landfills, *Sewage sludge, *Groundwater movement, *Path of pollutants, Sampling, Water wells, Water analysis, Chemical analysis. Identifiers: Arapahoe County (Colo.), *Denver Formation.

The Metropolitan Denver Sewage Disposal District and the city and county of Denver operate a sewage-sludge recycling site and a landfill in an area about 15 miles (24 kilometers) east of Denver. The assessment of the effects of these facilities on the ground-water system indicated that five wells perforated in alluvium were found to have markedly degraded water quality. One well is located in the landfill and water that was analyzed was obtained from near the base of the buried refuse, two others are located downgradient and near sewage-sludge burial areas, and the remaining two are located near stagnant surface ponds. Concentra-

tions of nitrate in wells downgradient from fields where sludge is plowed into the soil were higher than background concentrations due to the effects of the sludge disposal. No evidence of water-quality degradation was detected in deeper wells perforated in the bedrock formations. (Woodard-USGS) W77-12382

DESCRIPTIVE WATER QUALITY (DISPERSION) MODEL FOR THE DANUBE SECTION BETWEEN SZOB AND BUDAPEST (A DUNA, SZOB ES BUDAPEST KOZOTTI VONATKOZO, LEIRO JELLEGU VISMINOSEGI (DISZPERZIOS) MODELLI),

Vizgazdalkodasi Tudományos Kutató Intézet, Budapest (Hungary). L. Somlyódy. Hidrologiai Közlemények, Vol. 52, No. 2, p 71-78, February, 1977. 10 fig, 22 ref.

Descriptors: *Water quality, *Dispersion, *Mathematical models, *Computer models, *Sampling, Model studies, Curves, Streamflow, Mixing, Flow characteristics, Statistical methods, Spatial distribution, Simulation analysis, Systems analysis, Waste water treatment. Identifiers: *Danube River, Hungary, Dispersion models.

A linear descriptive model for representation of water quality along the Danube proved inadequate, since transverse changes observed to be greater than longitudinal variations. A dispersion model was investigated as the basis for a mathematical model for water quality which would correspond to the Hungarian filing system of river data. In this model, curvilinear relations are used to determine variations in background pollution as well as to examine individual discharges. The language used in programming the dispersion model is FORTRAN IV. Additional data required include: distributions of velocity, initial conditions, and dispersion coefficients. The dispersion model has been used for the Szob-Nagygyaros section of the Danube. It was found that closely spaced cross-sections are necessary for accurate descriptions. Only very slow mixing does occur, and differences between actual and computed input parameters may affect computed mixing intensities. (Schulz-FIRL) W77-12412

POLYCHLORINATED BIPHENYL CONCENTRATION IN SEWAGE AND SLUDGES OF SOME WASTE TREATMENT PLANTS IN SOUTHERN ONTARIO,

Canada Centre for Inland Waters, Burlington (Ontario). J. Lawrence, and H. M. Tosine. Bulletin of Environmental Contamination and Toxicology, Vol. 17, No. 1, p 49-56, January, 1977. 3 tab, 13 ref.

Descriptors: *Polychlorinated biphenyls, *Aroclors, *Industrial wastes, *Sewage treatment, *Sludge disposal, Organic compounds, Sludge digestion, Gas chromatography, Chemical wastes, Chemical analysis, Water pollution sources, Absorption, Municipal wastes, *Waste water treatment. Identifiers: Ontario (Canada), Canada.

Polychlorinated biphenyl (PCB) levels were monitored in raw sewage at six waste treatment plants and in sludge samples from four major urban areas in Ontario, Canada. PCB levels from grab samples were analyzed by gas chromatography and identified with chromatographs of standard Aroclors. One of the treatment plants surveyed received a large proportion of industrial wastes, while the other five treated only domestic wastes. Primary and activated sludge treatment were used by all facilities. Concentrations for the 36 samples collected at the six plants ranged from 1.5 ppb to 27.3 ppb with a mean of 27.3 ppb. Projections

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Group 5B—Sources Of Pollution

based on an annual plant loading at a daily flow of 236 million liters/day yielded an average value of 310 kg PCB/yr. Total PCB and contributions by individual Aroclors are listed in tabular form. Sludge digestion was observed to concentrate PCB with values reported as high as 2,085 ppb. Differences in contributions by individual Aroclors between the treatment plants examined were observed. Investigations on PCB levels in corn and grass grown on sludge-treated land indicated that although concentrations of PCB in leaves were comparable with concentrations in the applied sludge, uptake of PCB was not biologically accelerated by plants as has been observed for animals. Analyses of sludge samples from urban areas revealed PCB concentrations of 100 to 200 ppb. More stringent controls on the disposal of sludge containing PCB, particularly on land application, is suggested. (Schulz-FIRL)
W77-12414

SURVIVAL AND MOVEMENT OF ENTEROVIRUS IN CONNECTION WITH LAND DISPOSAL OF SLUDGES, Statens Forsøgstation, Vejen (Denmark). S. Damgaard-Larsen, K. O. Jensen, E. Lund, and B. Nissen.
Water Research, Vol. 11, No. 6, p 503-508, 1977. 2 fig, 6 tab, 16 ref.

Descriptors: *Viruses, *Lysimeters, *Percolation, *Microorganisms, *Soil disposal fields, Soil chemical properties, Soil contamination effects, Sludge disposal, Municipal wastes, Sewage disposal, *Waste water disposal, *Path of pollutants.
Identifiers: *Coxsackievirus B3.

Municipal sludges, seeded with coxsackievirus B3, were used in a study on the fate and distribution of enteroviruses during land disposal of sludge. Seeded sludges were placed on top of lysimeters containing different soil types, including a heavy clay soil, a neutral sandy soil, and an acidic sandy soil. Tritium was used to trace water movement through the columns. Analyses of lysimeter leachates indicated that soil type was not a controlling factor in virus inactivation, binding, or movement. Scintillation counting to determine tritium concentrations in lysimeter leachates revealed that water did not move through the lysimeters until three months after addition, and that little if any movement occurred in clayey soils. Leachate water samples did not contain demonstrable levels of coxsackievirus B3, with one exception which may have been due to a technical or analytical error. Viruses were apparently retained in the sludge layer on top of the lysimeter. Previous studies on the inactivation and movement of sludge-borne viruses are also described. (Schulz-FIRL)
W77-12434

BACTERIAL AND VIRAL PATHOGENS ASSOCIATED WITH LAND APPLICATION OF ORGANIC WASTES, Washington State Univ., Pullman. Coll. of Agricultural Research Center.
For primary bibliographic entry see Field 5E.
W77-12445

STORM WATER MANAGEMENT MODEL: LEVEL I - PRELIMINARY SCREENING PROCEDURES, Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. P. Heaney, W. C. Huber, and S. J. Nix.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 916. Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-76-275, October 1976. 77 p, 23 fig, 24 tab, 26 ref.

Descriptors: *Runoff forecasting, *Storm runoff, *Storm water, *Urban runoff, *Mathematical

models, Average runoff, Sewerage, Urban drainage, Forecasting, Urban hydrology, Storm drains, Combined sewers, Cities, Waste water treatment, Costs, Cost allocation, Water pollution sources.
Identifiers: Storm Water Management Model(SWMM).

The need for a more simplified user-oriented alternative to the USEPA Storm Water Management Model has prefaced the preparation of a four-level series of storm water management models. The Level I model emphasizes a nationwide assessment of storm water pollution control costs and quantity and quality estimates for urban runoff. For this model, the country is divided into five zones based on precipitation patterns. Each urban area is partitioned according to land use and type of sewer system. Results from runs of the Corps of Engineers' STORM model on a representative city in each of the regions were used to develop the assessment method and calibrate the run-off prediction technique. Population density, depression storage, and a runoff coefficient were used to generate annual wet-weather runoff and dry-weather flow estimates. Using limited available data, pollutant loadings for wet weather were estimated with respect to precipitation, land use, and population density. Annual dry- and wet-weather pollutant loadings were calculated. A method for determining the optimal combination of mixing and storage of runoff for various degrees of pollutant control has been developed for use in any U.S. city. Costs were assessed according to type of sewer system. Multipurpose planning using flow equalization between wet- and dry-weather treatment facilities, possibly incorporating storage during peak flow, was suggested as a means of reducing costs of adequate storm water pollution control. (Schulz-FIRL)
W77-12476

URBAN RUNOFF CHARACTERISTICS: VOLUME I - ANALYTICAL STUDIES, Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.
H. C. Pruehl, and C. N. Papadakis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 033. Price codes: A16 in paper copy, A01 in microfiche. Report EPA-600/2-76-217a, September 1976. 338 p, 44 fig, 28 tab, 100 ref, 5 append.

Descriptors: *Urban runoff, *Storm water, *Water management(Applied), *Hydrologic data, *Forecasting, *Rainfall-runoff relationships, Hydrograph analysis, Mathematical models, Computer models, Combined sewers, Sewerage, Overflow, Storm runoff, Urban hydrology, Water pollution sources.
Identifiers: Storm water management models, SWMM, UCUR, Cincinnati(OH).

Analysis and development of storm water management models are examined in the first part of a two-volume series on analytical studies and field investigations for the characterization of urban runoff and combined sewer overflows. Design storm hydrographs were developed for use in mathematical models which simulate urban runoff for design and analysis of sewer systems. Precipitation duration and intensity for a Cincinnati, Ohio, watershed were used to calculate synthetic storm patterns for seven selected design frequencies. Infiltration capacity curves for runoff prediction are derived. The University of Cincinnati Urban Runoff Model (UCUR), which contains submodels for infiltration, surface retention, overland flow, gutter flow, and sewer routing, is described. A general description, verification, and testing of the EPA Storm Water Management Model (SWMM) on the Bloody Run catchment area in Cincinnati, Ohio, are provided. Various methods for determining urban storm water runoff were tested and compared: empirical methods, the Los Angeles Hydrograph method, Izzard's method, the Chicago Hydrograph method, the Inlet method,

the Unit Hydrograph method, the RRL method, the UCUR model, and the SWMM model. Appendices include data card preparation, testing data, typical input and output for SWMM, and a copy of the program for the UCUR model. (See also W77-12478) (Schulz-FIRL)
W77-12477

URBAN RUNOFF CHARACTERISTICS: VOLUME II - FIELD INVESTIGATIONS, Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.
H. C. Pruehl, and C. N. Papadakis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 034. Price codes: A99 in paper copy, A01 in microfiche. Report EPA-600/2-76-217b, September 1976. 769 p, 424 fig, 314 tab.

Descriptors: *On-site investigations, *On-site data collections, *Urban runoff, *Storm water, *Storm runoff, Water pollution sources, Water quality, Combined sewers, Sewerage, Watersheds(Basins), Cities, Watershed management, Monitoring, Precipitation(Atmospheric), Model studies, Overflow, Sampling, Hydrologic data, Waste water treatment.

Field investigations on urban runoff in Cincinnati are described in the second part of a two-volume series on characterization of urban runoff and combined sewer overflows. The Bloody Run Sewer System encompasses approximately 2,380 acres of a combined sewer watershed. Data on the physical characteristics of the watershed are provided. The watershed was divided into 37 subareas for study purposes according to topography, zoning, land use, and sewer network. Manhole locations and the size, slope, and length of sewer pipes are listed for each of the 37 subareas. Five storm and six dry weather flow stations were set up to collect flow quantity and quality data. Storm runoff samples were collected at the five monitoring stations from October 29, 1970 to June 28, 1972. Laboratory analyses were carried out for total solids, suspended solids, volatile suspended solids, biochemical oxygen demand, chemical oxygen demand, chlorides, and pH. Runoff quality and quantity data are provided for individual storms during the study period. Information collected was used to evaluate storm water management models developed by EPA and the University of Cincinnati. (See also W77-12477) (Schulz-FIRL)
W77-12478

CATCHBASIN TECHNOLOGY OVERVIEW AND ASSESSMENT, Metcalf and Eddy, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5D.
W77-12495

QUALITY OF URBAN FREEWAY STORM WATER, Wisconsin Dept. of Transportation, Madison. Div. of Highways.
J. B. Jodie.
In: Water Quality, Conduits, and Geometrics. Transportation Research Record 556, 1975. p 1-5, 2 fig, 2 tab, 9 ref.

Descriptors: *Urban runoff, *Storm water, *Surface runoff, *Water pollution, *Model studies, Data collections, Monitoring, Salts, Snow, Storms, Storm runoff, Cities.
Identifiers: Milwaukee(WI).

The quality of storm-water runoff from urban freeways was monitored during a year-long sampling and testing program in Milwaukee County, Wisconsin. Sodium chloride, calcium chloride, total solids, volatile total solids, suspended solids, volatile suspended solids, 5-day BOD, total nitrogen, pH, total phosphorus, ammonia, fecal coliforms, lead, dissolved oxygen, nitrates, and

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Sources Of Pollution—Group 5B

nitrites were measured for two storm water outfall locations. Analyses indicated that parameter concentrations were higher during the first hour of a rainstorm and tended to be very high during snowstorms. High salt concentrations were observed during winter and spring. No significant differences in storm water quality were observed between the two sampling stations. Total solids, suspended solids, and BOD were higher in storm water than in treatment plant effluent. Parameter concentrations for the Milwaukee study and for other cities are listed. Additional research into contamination by and treatment of urban runoff is suggested. (See also W77-12499) (Schulz-FIRL) W77-12500

DISTRIBUTION OF MANGANESE, NICKEL, ZINC, CADMIUM, AND ARSENIC IN SEDIMENTS AND IN THE STANDARD ELUTRIATE, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab. For primary bibliographic entry see Field 5A. W77-12574

DRAINAGE PRACTICE IN IMPERIAL VALLEY, CALIFORNIA, Agricultural Research Service, Brawley, Calif. Imperial Valley Conservation Research Center. For primary bibliographic entry see Field 4A. W77-12581

LAND USE AND WATER QUALITY IN THE FLATHEAD DRAINAGE, Montana Univ., Flathead Lake. Biological Station. T. R. Seastedt, and T. F. Tibbs. Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 282. Price codes: A12 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, February 1974 255 p, 11 fig, 8 tab, 174 ref.

Descriptors: *Water pollution, *Water pollution control, *Land use, *Land management, *Methodology, Management, Planning, Watersheds(Basins), Ecology, Land development, Montana, On-site data collections. Identifiers: *Flathead Lake(MT).

The study's objectives were to compile data on water quality and land management practices affecting water quality in the Flathead drainage; to evaluate methodologies employed in obtaining water quality data in this region, and examine methodologies currently utilized in land management activities to prevent deleterious effects to water quality; and to develop methodologies for the assessment of important ecological parameters that might lead to prevention and abatement of water quality problems in the drainage, and suggest methods to prevent continued degradation of water quality from present land use activities. The major components of the water and land use problems in the drainage include rural domestic wastewater, municipal sewage, livestock wastes, farming practices, subdivisions, recreation activity, forestry practices, industrial pollution, reservoirs, and the associated rapid population and economic growth. The authors feel that their assessment of pollution inputs are extremely rough estimates, necessitating further research into deleterious effects of land use on water quality. The data are thought to be reliable enough to justify implementation of suggested control measures. Recommendations are made for improvement of the area's water quality monitoring system. The limitations of the monitoring system, including lack of baseline data and funding, are discussed. (Nessa-NC) W77-12582

NUTRIENT MOVEMENT IN STREAMFLOW FROM AGRICULTURAL WATERSHEDS IN THE GEORGIA COASTAL PLAIN, Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center.

L. E. Asmussen, J. M. Sheridan, and C. V. Booram, Jr. Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 28 p, 12 fig, 3 tab, 7 ref.

Descriptors: Nitrates, Nitrites, Runoff, Watersheds(Basins), Return flow, *Georgia, Streamflow, *Nitrogen, *Phosphates, *Chlorides, Nutrients, Coastal plains, *Agricultural runoff, *Path of pollutants, Water pollution sources.

As baseline information on nonpoint pollution, the monitoring of nitrogen, phosphates, and chloride was begun in 1974 at 9 locations within a predominately agricultural Upper Coastal Plain watershed (311 to 32,751 ha) at Tifton, Georgia. Stream flow was continuously measured at all sites. Chemical load is computed for one continuously sampled site, and seasonal relationships are noted. (Skogerboe-Colorado State) W77-12610

CONCEPTS IN THE CONTROL OF NONPOINT WATER POLLUTION, Agricultural Research Service, Chickasha, Okla. M. H. Frede, D. A. Woolhiser, J. H. Caro, B. A. Stewart, and W. H. Wischmeier. Presented at the National Water Resources and Ocean Engineering Convention of the American Society of Civil Engineers, April 5-8, 1976, San Diego, California, 24 p, 8 fig, 2 tab, 11 ref. ASCE Preprint 2667. \$1.00.

Descriptors: *Sediments, *Salt salinity, Saline water, Saline soils, *Nutrients, Fertilization, Pesticides, Return flow, *Water pollution sources, Water pollution control, *Pesticide residues. Identifiers: *Nonpoint pollution sources.

Sediment, salt, nutrients, and pesticides are the principal types of pollutants from nonpoint sources. Pollution from nonpoint sources is very difficult to identify and monitor. While standards have been established for municipal, industrial, and agricultural uses of water, adequate standards have not yet been developed to protect the environment. The lack of standards makes it very difficult to judge the adequacy of any control program. In developing a control program there are some methods that can be used over a broad area. These include education, incentive, taxation, or legal penalties. All have good and bad points. Many of the practices must be designed for a specific field. In some cases, a practice may solve one problem but create another. The Agricultural Research Service has developed a set of flow charts to assist land planners in selecting practices for croplands. These charts should cause the user to recognize the possible pollution sources and to evaluate the consequences of any practices selected to control these sources. Similar flow charts could be developed for other land uses. (Skogerboe-Colorado State) W77-12611

HYDROCHEMICAL CONDITIONS OF THE DNEIPER IN THE REGION OF THE TRIPOL'YE STATE REGIONAL ELECTRIC POWER STATION, (IN RUSSIAN), Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. S. I. Kosheleva. Gidrobiol Zh 12(1), p 20-25, 1976.

Descriptors: *Electric powerplants, Rivers, Absorption, Water quality, *Dissolved oxygen, *Nitrogen, *Organic matter, *Biochemical oxygen demand. Identifiers: Tripolye, Ukrainian-Ssr, *USSR(Dnieper River), *Biochemical oxygen uptake.

Discharging the circulatory waters of the station (in the Ukrainian SSR, USSR) caused no essential

changes in the hydrochemical conditions of the river along its 100 km section. The main indexes determining water quality (dissolved O₂, N forms, organic substances and biochemical O₂ uptake (BOU)) were within the limits of average long-term values. Values of oxidability and BOU5 were 1.5-2 times as high as the maximum admissible values before the construction of the heat electric power station and during its operation.—Copyright 1976, Biological Abstracts, Inc. W77-12613

NONPOINT SOURCES: STATE-OF-THE-ART OVERVIEW, Texas A and M Univ., College Station. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5G. W77-12614

RESOURCE ADEQUACY IN LIMITING NON-POINT POLLUTION, Iowa State Univ., Ames. E. O. Heady. Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 16 p, 3 fig, 6 tab, 2 ref.

Descriptors: Computer programs, *Model studies, Computer models, Runoff, Sedimentation, Economics, *Pollution abatement, Water pollution sources, *Regional analysis. Identifiers: *Nonpoint pollution sources.

A national programming model of 105 regions, 41 water supply regions and 9 land groups per region is used to evaluate potentials in reducing nonpoint pollution through control of runoff and sedimentation. Evaluation of economic outcomes also is made for alternatives specified to enhance environmental quality. (Skogerboe-Colorado State) W77-12615

POLLUTION PROBABILITY ESTIMATED BY SMALL STORM FREQUENCY, Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering. R. B. Lewis, V. L. Hauser, R. G. Menzel, and J. D. Ross.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 23 p, 10 fig, 4 tab, 10 ref.

Descriptors: Surface runoff, Runoff, *Return flow, Water quality, Management, Hydrologic data, Nebraska, Corn(Field), Crop production, *Probability, Water pollution sources, *Agricultural runoff. Identifiers: Contour tillage, *Storm frequency.

The concentration of chemicals in surface runoff water is often an important consideration. Water soluble chemicals which are applied to the surface of plants or soil may appear in highest concentration in runoff water from small storms. Because of this, some aspects of water quality management require quite different hydrologic information than has been required to solve problems considered in the past. This study of small storms in the central Great Plains near Hastings, Nebraska, revealed much about small storms and their relation to water quality. Contour cultivation of corn substantially decreased the number of runoff events resulting from small storms, and thus substantially decreased the likelihood of pollution from surface applied chemicals. This finding agrees with past concepts, like the large decrease in annual runoff from corn which results from contour tillage. However, contour tillage of small grains (wheat and oats) did not cause a corresponding decrease in the number of runoff events from small storms. This finding conflicts with annual runoff data that show a decrease in runoff from contour tillage of small grains. (Skogerboe-Colorado State) W77-12620

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

MERCURY IN SHARK IN WESTERN AUSTRALIA - A PRELIMINARY REPORT, Western Australia Dept. of Fisheries and Fauna, Perth, Marine Research Labs. D. A. Hancock, J. S. Edmonds, and J. J. Edinger. Fisheries Research Bulletin of Western Australia, Vol. 18, p 1-22, 1977. 3 fig, 10 tab, 19 ref, 1 append.

Descriptors: *Aquatic life, *Sharks, *Elasmobranchs, *Marine fish, *Metals, *Mercury, *Path of pollutants, Sampling, Animal physiology, Australia, Metabolism, Absorption, Bioassay, Water quality, Public health, Commercial fish, Commercial fishing. Identifiers: Bioaccumulation, Tissue analysis, Whiskery shark, Gummy shark, Bronze whaler shark, Furgaleus ventralis, Carcharhinus obscurus, Emissola antarctica.

Linear and curvilinear regressions relating mercury concentration and size were used in conjunction with catch data to estimate the average concentration in the three major shark species in the Western Australia fishery industry. The three species were whiskery (Furgaleus ventralis), bronze whaler (Carcharhinus obscurus) and gummy (Emissola antarctica) sharks. The average mercury concentration for the 3 species was found to be approximately 0.75 ppm. The relevance of this to Public Health regulations was discussed and the need for information on consumption of shark stressed. (Klein) W77-12635

STREAM POLLUTION BY AN ORGANOMERCURY COMPOUND, Freshwater Fisheries Lab., Pitlochry (Scotland). L. A. Caines, and A. V. Holden. Bulletin of Environmental Contamination and Toxicology, Vol 16, No 4, p 483-490, 1976. 3 fig, 4 tab, 6 ref.

Descriptors: *Organic compounds, *Path of pollutants, *Mercury, Water pollution sources, Trout, Salmonids, Toxicity, Water quality, Sediments, Plants, Aquatic plants, Analytical techniques, Brown trout, Streams, Metals, Water pollution effects. Identifiers: Bioaccumulation, Tissue analysis, Graylings, Thymallus thymallus.

Brown trout (Salmo trutta) and grayling (Thymallus thymallus) caught in areas with no obvious contaminating source had mercury levels in muscle tissue of less than 0.10 ppm wet weight. Total mercury levels up to 20 ppm and 12 ppm in brown trout and grayling, respectively, were recorded, indicating a pollution source. Stream sediment at the culvert out-fall point gave a maximum concentration of 100 ppm dry weight. Macrophyte rooted in the contaminated sediment also gave high levels of mercury contamination. A treatment program produced significant reductions in the total mercury residue levels in fish muscle, sediments, and aquatic plants. (Klein) W77-12644

PHYSICAL MODEL OF MARINE PHYTOPLANKTON CHLORINATION AT COASTAL POWER PLANTS, Woods Hole Oceanographic Institution, Mass. J. C. Goldman, and J. A. Davidson. Environmental Science and Technology, Vol 11, No 9, p 908-913, 1977. 8 fig, 3 tab, 25 ref.

Descriptors: *Model studies, Research and development, *Powerplants, *Chlorination, *Phytoplankton, *Biomass, Growth rates, Effluents, Aquatic plants, Water pollution sources, Water quality, Chlorine, Productivity, Population, Algae, Path of pollutants, Phosphorus, Environmental effects, Toxicity. Identifiers: *Phaeodactylum tricornutum, Marine phytoplankton.

A physical model of the impact of coastal power plant chlorination on marine phytoplankton was developed. Several steady state biomass levels of the test algae Phaeodactylum tricornutum were established in continuous cultures by varying the concentration of phosphorus in the growth medium. The algae were then exposed to combinations of chlorine and temperature stress for 1 hr, and deviations from the prestress steady state were observed over long periods of time. Three types of response occurred that were a function of the applied chlorine/biomass ratio: no effect, effect followed by recovery, and complete washout. It was suggested from the results that, given the typical organic loads present in coastal waters, excessive levels of chlorine may be in current use, and that the effects on entrained phytoplankton probably have little bearing on the ultimate effect on the standing crop in the receiving water. The most important considerations were the hydrologic, biological, and chemical qualities of the receiving waters themselves. (Katz) W77-12645

MERCURY CONTENT OF SEVERAL PREDACIOUS FISH IN THE ANDAMAN SEA, Chulalongkorn Univ., Bangkok (Thailand). Dept. of Marine Science. P. Menasveta, and R. Siriyong. Marine Pollution Bulletin, Vol. 8, No. 9, p. 200-204, 1977. 4 fig, 4 tab, 16 ref.

Descriptors: *Mercury, *Marine fish, *Metals, *Predation, Path of pollutants, Carnivores, Analytical techniques, Fishkill, Food chains, Food webs, Seas, Toxicity, Water quality, Sharks, Fish physiology, Pacific Ocean. Identifiers: *Andaman Sea, *Thailand, Yellowfin tuna, Bigeye tuna, Bioaccumulation, Tissue analysis, Great Blue Shark, Hammerhead shark.

During April 1975 thirty-six muscle samples of six predacious species of fish from the Andaman Sea were collected for an analysis of their total mercury concentrations. The total mercury levels ranged from 0.026 to 0.234 ppm in yellowfin tuna, from 0.027 to 0.233 ppm in bigeye tuna, and from 0.057 to 0.478 ppm in four species of shark. Statistical analysis also showed positive linear regression and there was correlation between the mercury concentration and the weight of the yellowfin tuna, bigeye tuna, and shark. The rates of total mercury accumulation in yellowfin and bigeye tuna were not significantly different. A comparison between the total mercury level in the Andaman yellowfin and the Central Pacific Yellowfin tuna are discussed. (Katz) W77-12652

TRACE METALS IN FINFISH FROM THE NEW YORK BIGHT AND LONG ISLAND SOUND, National Marine Fisheries Service, Milford, Conn. Milford Lab. R. A. Greig, and D. R. Wenzloff. Marine Pollution Bulletin, Vol. 8, No. 9, p. 198-200, 1977. 1 fig, 1 tab, 7 ref.

Descriptors: *Trace elements, Metals, *Heavy metals, *Silver, *Cadmium, *Chromium, *Copper, *Mercury, *Manganese, *Nickel, *Lead, *Zinc, *Teleosts, Sewage disposal, Sewage sludge, Water pollution sources, Chemical wastes, New York. Identifiers: Tissue analysis, Bioaccumulation, Dogfish, Hake, Flounder, New York Bight, Long Island Sound.

Concentrations of silver, cadmium, chromium, copper, mercury, manganese, nickel, lead and zinc were measured in five species of finfish collected from the New York Bight and two from Long Island Sound. With few exceptions the trace element contents were similar for the various species examined and also for a single species when comparing catch locations. Metal levels also were similar to concentrations reported by two other in-

vestigators who studied fish from the North Atlantic. (Katz) W77-12654

TOXIC CHEMICALS IN CANADIAN FISH-EATING BIRDS, Canadian Wildlife Service, Delta (British Columbia). K. Vermeer, and D. B. Peakall. Marine Pollution Bulletin, Vol. 8, No. 9, p. 205-210, 1977. 4 fig, 37 ref.

Descriptors: Organic compounds, *Chlorinated hydrocarbon pesticides, *Mercury, *Pesticides, *DDE, *Polychlorinated biphenyls, *Toxicity, *Birds, Waterfowl, *Great Lakes, *Gulls, Reproduction, Mortality, Bird eggs, Water birds, Population, Path of pollutants, Water quality, Food chains, Arochlor. Identifiers: *Cormorant, *Terns, Bioaccumulation, Tissue analysis.

Cross-country comparison of DDE and PCB residue levels in cormorant, gull and tern eggs in Canada reveal that bird populations at the Great Lakes were most contaminated with these pollutants. DDE levels were correlated with reproductive failure in Double-crested Cormorants in the Great Lakes with eggshell thinning as a major factor. Low reproductive success in Herring Gull colonies at Lake Ontario was associated with high chlorinated hydrocarbon levels in eggs. Fish-eating birds in the Wabigoon River system, northwestern Ontario, were among the most known mercury contaminated birds. It was suggested that the effects of mercury on the reproduction of fish-eating birds should be further examined there. (Katz) W77-12655

FURTHER STUDIES UPON A STEEL WORKS EFFLUENT, University of Strathclyde, Dumbartonshire (Scotland). Marine Lab. O. J. Abbott, and E. J. Perkins. Marine Pollution Bulletin, Vol. 8, No. 9, p. 210-213, 1977. 2 fig, 3 tab, 3 ref.

Descriptors: *Water pollution sources, *Effluents, *Biota, *Wastes, *Steel, *Industrial wastes, *Productivity, Toxicity, Environmental effects, Aquatic life, Invertebrates, Ecosystems, Water quality, Benthos, On-site-investigation, Molluscs, Bioassay. Identifiers: *Steelworks effluents, England, Solway firth, Starfish.

The abundance and diversity of the benthic biota in close proximity to a steelworks outfall confirm preliminary conclusions that it likely has little environmental effect. Rapid dilution of effluent in the turbulent waters, coupled with the lack of marked toxic effects indicates that the current practice of effluent disposal at this plant is not inimical to a healthy marine biota. (Katz) W77-12656

METHOD FOR TREATING SEPTIC TANK EFFLUENT SEEPAGE BEDS AND THE LIKE, Wisconsin Alumni Research Foundation, Madison. (Assignee). For primary bibliographic entry see Field 5D. W77-12688

QUALITY MONITORING OF IRRIGATION WATER AND RETURN FLOWS IRRIGATION SEASON 1974, Max C. Fleischmann Coll. of Agriculture, Reno, Nev. J. C. Guitjens, C. N. Mahannah, and W. W. Miller. Publication No R114, July 1976. 81 p, 36 fig, 19 tab, 42 ref, 8 append.

Descriptors: *Irrigation water, *Return flow, Irrigation practices, *Irrigation effects, Tailwater, Water quality, Sampling, Data collections, *Monitoring, Water pollution, Pollutant, identification.

Quantitative and qualitative measurements of irrigation applications (head water) to and return flow (tail water) from selected fields were made at the Sarman, Heritage and Witt Ranches in the Carson Valley. Totalizing flow meters were used to measure quantity of irrigation water application as well as the quantity of surface return flow (tail water) at each site. Water quality samples were taken at each of these metering points at 12-hour intervals and analyzed for temperature, dissolved oxygen, biochemical oxygen demand, orthophosphate, nitrate-nitrogen, turbidity, electrical conductivity, pH, calcium + magnesium, sodium, bicarbonate, chloride, and sulfate. (Skogerboe-Coloado State) W77-12725

GROUNDWATER OF VOJVODINA, ITS QUALITY AND APPLICABILITY FOR IRRIGATION

Novi Sad Univ. (Yugoslavia). Faculty of Agriculture.

B. Zivkovic.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 350-357. 1 fig, 1 tab, 9 ref.

Descriptors: *Groundwater, *Water quality, Dissolved solids, *Irrigation water, Saline soils, Salinity, Management.

On the basis of the results achieved in groundwater investigations and their applicability in Vojvodina the following conclusions can be made: (1) Groundwater in Vojvodina is mostly of poor quality, has a relatively high content of dissolved salts, and should not be used for irrigation; (2) Underground water in the watersheds of the Danube, Tisza and Sava can be used for irrigation due to their good quality; (3) In order to prevent further soil salinization it is necessary to lower the groundwater level to a harmless depth which, due to the natural conditions in Vojvodina, is 200-250 cm; and (4) It is important to provide expert control both over the usage of the groundwater for irrigation and the control of soil salinization. (See also W77-12726) (Skogerboe-Coloado State) W77-12728

CONVECTIVE TRANSPORT OF SOLUTES IN AND BELOW THE ROOT ZONE

Agricultural Research Service, Riverside, Calif. Salinity Lab.

P. A. C. Raats.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 290-298, 4 fig, 10 ref.

Descriptors: *Return flow, *Salinity, Saline water, Irrigation, Irrigation effects, *Water quality, Dissolved solids, Root zone, Path of pollutants. Identifiers: *Salt transport(Soils).

The first objective of research related to the management of saline water for irrigation is to find the space-time trajectories of bits of water. The second objective is to determine the change in quality of these bits of water, in particular the changes in solute concentration due to evaporation at or near the soil surface and selective uptake of water by plant roots. Within the root zone, the details of the water movement and of the changes in concentration depend on the relative magnitude of the components of the water balance, on the distribution of the water uptake, and on the irrigation frequency. Below the root zone, the water table and the drainage facility. If the drains or ditches are widely spaced relative to the depth of the first impermeable layer, then the influence of the details of the flow near the drains or ditches is

small, and the transit times tend to be exponentially distributed. This in turn implies some simple input/output relationships and provides a good reference for comparison of more complicated geometries and distributions of inputs and outputs. (See also W77-12726) (Skogerboe-Coloado State) W77-12732

FATE OF SALTS FROM WATER AND MANURE IN A 4-YEAR FIELD EXPERIMENT

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

For primary bibliographic entry see Field 5G.

W77-12755

DISTRIBUTION AND SEASONAL VARIABILITY OF MICRONUTRIENTS IN CERTAIN SALT AFFECTED SOILS OF NORTHERN GREECE

Democritus Nuclear Research Center, Athens (Greece).

E. P. Papanicolaou, Tr. Anagnostopoulos, and C. Nobel.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 175-186. 12 fig, 19 ref.

Descriptors: *Nutrients, Salts, Zinc, Iron, Copper, Boron, Manganese, Leaching, Salinity, *Saline soils, *Distribution, Path of pollutants. Identifiers: *Greece.

In two salt affected areas of Northern Greece the distribution and seasonal variability of B, Cu, Mn, Zn, and Fe along with the distribution and variability of salts are presented. The levels of boron are high in the soils of both areas and probably toxic to various plant species depending upon their relative tolerance to this element. Copper and iron are probably present in normal levels while the levels of manganese and zinc are probably low for the soils of both areas. Regarding seasonal variability there is evidence of leaching for boron, copper, zinc, and iron and also for salts during the rainy period, while the data for manganese are rather inconclusive. It is concluded that considerable amounts of micronutrients will be leached out these soils during reclamation. (See also W77-12726) (Skogerboe-Coloado State) W77-12756

DETAILED RETURN FLOW SALINITY AND NUTRIENT SIMULATION MODEL

Bureau of Reclamation, Denver, Colo.

For primary bibliographic entry see Field 5G.

W77-12757

A CONCEPTUAL HYDROSALINITY MODEL FOR PREDICTING SALT LOAD IN IRRIGATION RETURN FLOWS

California Univ., Davis. Water Science and Engineering Section.

K. K. Tanji.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 49-70. 6 fig, 6 tab, 13 ref, append.

Descriptors: *Model studies, Simulation analysis, *Salinity, *Return flow, Irrigation, Irrigation effects, Forecasting. Identifiers: *Hydrosalinity modeling.

Presented herein is a description and applications of a steady-state conceptual hydrosalinity model. The model may serve as a first-order approximation in lieu of more detailed and refined models for evaluating mass emission of salts from irrigated agriculture. (See also W77-12726) (Skogerboe-Coloado State) W77-12758

HYDROSALINITY MODELING OF IRRIGATION RETURN FLOW IN THE MESILLA VALLEY, NEW MEXICO

New Mexico Inst. of Mining and Technology, Socorro.

S. G. McLin, and L. W. Gelhar.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 28-48. 7 fig, 2 tab, 28 ref.

Descriptors: *New Mexico, *Model studies, Simulation analysis, Aquifers, *Return flow.

Identifiers: *Hydrosalinity modeling, Mesilla Valley(N Mex).

The preliminary simulation results for the Mesilla Valley indicate a need to improve the input data and model structure. Several sensitivity analyses conducted with the model in its current preliminary form show the effects of consumptive water use, soil chemistry, and groundwater chemistry. The scheme currently used in the model to transfer water between the aquifer and the stream may be physically unrealistic in that it is independent of aquifer properties and water level. Improvements which relate the stream-aquifer interaction to aquifer properties and water level will be incorporated after the model has been tested over a long time frame in its current form. Baseflow recession and well drawdown data will be used to estimate the required aquifer parameters for the proposed model improvements. (See also W77-12726) (Skogerboe-Coloado State) W77-12759

IRRIGATION MANAGEMENT WHERE SALINITY SOURCES AND SINKS ARE PRESENT

Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.

For primary bibliographic entry see Field 3C.

W77-12760

EFFECT OF CITRATE AND CARBONATE BASED DETERGENTS ON WASTEWATER CHARACTERISTICS AND TREATMENT

Environmental Protection Service, Ottawa (Ontario). Water Technology Centre.

For primary bibliographic entry see Field 5D.

W77-12773

UPPER BAY SURVEY, VOL. I. EXECUTIVE SUMMARY

Westinghouse Ocean Research Lab., Annapolis, Md.

T. O. Munson.

Final Report to the Maryland Department of Natural Resources, 54 p, 1976. 21 fig.

Descriptors: *Chlorinated hydrocarbon pesticides, *Organic compounds, *Bays, *Path of pollutants, *Chesapeake Bay, Ecosystems, Sediments, Bacteria, Zooplankton, Shellfish, Toxins, Water pollution sources, Water quality, DDT, On-site investigation, Sediments, Polychlorinated biphenyls, Streamflow, Suspended solids, *Estuaries, Estuarine environment. Identifiers: Susquehanna River, *Upper Chesapeake Bay.

The pathways of pollutants through the Upper Chesapeake Bay were investigated. Chlorinated hydrocarbons (CHC) were found associated with suspended sediments, zooplankton, shellfish, and bacteria. The principle phases of the hydrologic cycle were contaminated with hydrocarbons. The Susquehanna River was an important source of chlorinated hydrocarbon contaminants in the Upper Chesapeake Bay. The finer-sized sediment carried the greater burden of CHC. Suspended sediments transported bacteria as well as CHC in the waters of the Chesapeake Bay. The suspended sediments were the main reservoir in the bay of CHC and probably of bacteria. Bottom sediments constituted the chief sink of chlorinated hydrocarbons and probably of bacteria. (See also W77-12786) (Katz)

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

W77-12785

UPPER BAY SURVEY VOL. IV. NUMERICAL MODELING.

Westinghouse Oceanic Div., Annapolis, Md.
T. O. Munson, D. K. Ela, and C. Rutledge, Jr.
Final Report, Maryland Department of Natural Resources, 65 p, 1975. 30 fig, 3 tab, 8 ref.

Descriptors: *Model studies, Research and development, *Computer models, *Programs, *Numerical analysis, Mathematical studies, Testing, Research facilities, Projects, Computer programs, *Chesapeake Bay, Mathematical models, Water pollution sources, Diffusion, Sediments, Settling velocity, Deposition (Sediments), Organic compounds, Advection, Polychlorinated Biphenyls, Chlorinated hydrocarbon pesticides.
Identifiers: *Upper Chesapeake Bay.

A numerical three-dimensional model was applied to the Upper Chesapeake Bay to predict the source field from the concentration field of passive concentration subject to advection, diffusion, and vertical settling velocity. The complete model consisted of ten discrete programs necessary for a three-dimensional model and versatility of the model as a whole. The most realistic results were obtained by using the model to predict the vertically integrated source function. The model was originally designed to predict the vertically integrated source function. The model was originally designed to predict the source field of sediment-borne chlorinated hydrocarbons (CHC) and polychlorinated biphenyls (PCB). The model was finally run as a predictor of suspended sediment sources only. Such a field, multiplied by a mean PCB and CHC concentration (per unit mass of sediment) gave one component of the PCB or CHC source field (i.e., the field that would result if the PCB or CHC concentration were constant in space) but not that component which was due to spatial variations in the PCB or CHC concentrations. Sufficient concentration data can be obtained in the future to achieve the original purpose of predicting the source field. (See also W77-12785) (Katz)
W77-12786

STORM WATER MANAGEMENT MODEL STUDY, VOLUME III, USER'S MANUAL.

Proctor and Redfern Ltd., Toronto (Ontario); and MacLaren (James F.) Ltd., Toronto (Ontario).
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 62, 1977. Environmental Protection Service, Environment Canada, Ottawa, Canada. 421 p, 25 fig, 50 tab, 5 append. 73-5-10.

Descriptors: *Storm water, *Model studies, Management, Storm runoff, Water quality, Analytical techniques, Data processing, *Computer, Programs.
Identifiers: *Canadian Storm Water Management Model (SWMM), User information.

This volume, Volume III of a three volume report, is the User's Manual for the Canadian Storm Water Management Model developed for Fisheries and Environment Canada and the Ontario Ministry of the Environment. This Canadian study has expanded the capabilities of the original SWMM (U.S. Environmental Protection Agency). Methods of aggregating the properties of individual subcatchments into a single equivalent catchment are described. These can lead to a considerable reduction in data preparation and computer processing time. A generalized quality model was developed, based on SWMM and STORM (U.S. Army Corps of Engineers) models, capable of discussed and demonstrated, and a fully operational package of models, capable of simulation of all aspects of storm water flow and quality, has been prepared for application to Canadian conditions. User information on the set up and operation of the entire model, as well as set up and use

of the individual program blocks, is presented in this manual. Reference is made to the U.S. Environmental Protection Agency User's Manual, where necessary, to avoid duplication. (WATDOC)
W77-12792

PROCEEDINGS OF A CONFERENCE ON EMERGING ENVIRONMENTAL PROBLEMS: ACID PRECIPITATION.

Environmental Protection Agency, New York.
For primary bibliographic entry see Field 5A.
W77-12809

NITRATE-N PERCOLATION THROUGH IRRIGATED SANDY SOIL AS AFFECTED BY WATER MANAGEMENT.

Agricultural Research Service, Akron, Colo.
D. E. Smika, D. F. Heermann, H. R. Duke, and A. R. Bathchelder.
Agronomy Journal, Vol. 69, No. 4, p 623-626, July-August, 1977, 3 fig, 3 tab, 9 ref.

Descriptors: *Water management (Applied), *Percolation, *Fertilizers, *Water pollution, *Nitrates, Nitrogen, Groundwater, Soil types, Sands, Irrigation effects, Irrigation systems, Sprinkler irrigation.

A study was conducted to determine the magnitude and difference in NO₃N losses from two widely different but current farmer-used fertilizer management practices with scheduled irrigation systems on sandy soils. The experiments were conducted during three consecutive corn growing seasons on three irrigation systems in Colorado. Nitrate-N percolation losses were measured in water samples collected at 150 centimeters below the soil surface in vacuum extractors. The actual amount of NO₃N that will move through the soil is proportional to the concentration of NO₃N in the soil and the amount of water that moves through the soil. The movement of nitrogen fertilizer below the major root zone of corn grown on loamy fine sand soils can be kept very small with proper water and fertilizer management, thereby minimizing the NO₃N pollution potential of the groundwater. (Jamail-Arizona)
W77-12830

SIMULATION OF PHOSPHORUS CYCLING IN SEMIARID GRASSLANDS.

Agricultural Research Service, Fort Collins, Colo. Phosphorus Lab.
For primary bibliographic entry see Field 2G.
W77-12832

THE EFFECT OF STABLE DISSOLVED-OXYGEN STRESS ON MARINE BENTHIC INVERTEBRATE COMMUNITY DIVERSITY.

Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
J. A. Nichols.
Internationale Revue Gesamte Hydrobiologie, Vol. 61, No. 6, p 747-760, 1976. 4 fig, 1 tab, 29 ref, 1 append.

Descriptors: *Seasonal, Water quality, *Speciation, *Distribution patterns, *Dissolved oxygen, Aerobic conditions, Biological communities, Depth, Water properties, Distribution, Oxygen, Invertebrates, Benthos, Stress, Resistance, Atlantic Ocean.
Identifiers: *Specie diversity, *Anoxic waters, Fosa de Cariaco, Venezuela, Oxygen profile.

The Fosa de Cariaco off the coast of Venezuela is an anoxic basin which is subject to small seasonal fluctuations in the depth of the anoxic water. Samples taken in the interface region (between oxic and anoxic waters) contained from 13 to 37 species represented by 117 to 380 individuals. Species diversity, based on H'(s) was greater than previously reported for samples from oxygen minimum

regions. It is suggested that the relatively stable low dissolved-oxygen concentrations allow the development of diverse assemblages. (Klein)
W77-12846

LEVELS OF CHLORINATED HYDROCARBONS IN EGGS OF DOUBLE-CRESTED CORMORANTS FROM 1971-1975.

Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
V. Zitko.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 4, p 399-409, 1976. 1 fig, 2 tab, 9 ref.

Descriptors: *Organic compounds, *Chlorinated hydrocarbon pesticides, *Toxicity, *Path of pollutants, *Birds, *Water birds, DDD, DDT, Polychlorinated biphenyls, Aroclors, Analytical techniques, Monitoring.
Identifiers: *Double-crested cormorants, *Cormorants, *Bioaccumulation, Tissue analysis.

The results of five years of monitoring chlorinated hydrocarbons (CHC) in eggs of double-crested cormorants (*Phalacrocorax auritus*) were presented. A decrease of PCB and DDE levels was indicated from 1971-1973 with no change thereafter. Some penta-, hexa-, hepta-, and octachlorobiphenyls were much more abundant in the eggs than Aroclor 1254. The present relatively low levels of CHC in eggs of cormorants indicated no detectable effects on the cormorant population. (Klein)
W77-12847

PHYTOPLANKTON PRODUCTION AND DISTRIBUTION IN HOWE SOUND, BRITISH COLUMBIA: A COASTAL MARINE EMBAYMENT-FJORD UNDER STRESS.

Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
J. C. Stockner, D. D. Cliff, and D. B. Buchanan.
Journal of the Fisheries Research Board of Canada, Vol. 34, p 907-917, 1977. 8 fig, 1 tab, 30 ref.

Descriptors: *Bays, *Biomass, *Phytoplankton, *Growth rates, *Productivity, *Distribution patterns, Primary productivity, Aquatic plants, Aquatic life, Water quality, Sounds, Straits, Ecosystems, Niches, Succession, Water pollution sources, Turbulence, Environmental effects, Population, Pulp and Paper Industry, Mine wastes. Identifiers: British Columbia, *Howe Sound, Colored effluent, Pulping wastes, Turbid mine tailings.

Phytoplankton production and distribution were examined over a 2-year period in relation to man-induced and natural factors that stress the system by mainly affecting the light regime in surface layer(s) of Howe Sound, British Columbia. Production rate and biomass values were greatest at the seaward boundary of the Sound where surface waters mix with the Strait of Georgia. Production decreases linearly in waters mix with the Strait of Georgia. Production decreases linearly in an up-inlet direction, reaching minimum values at the head of the Sound where the influence of the turbid Squamish River discharge is greatest. Annual production in the boundary waters of the Sound for 1973 and 1974 was 300 and 516 g C m⁻², compared to an average of 118 and 163 for remaining stations. Strong light attenuation by the turbid Squamish River and flushing by the seaward moving surface layer were considered the most important factors controlling phytoplankton production and distribution in Howe Sound. Colored effluent from two pulp mills and turbid mine tailings and gravel washing water were minor perturbants to the system as a whole, but in affected bays and subregions of the Sound their effects on phytoplankton production were considerable. Annual production in Howe Sound was slightly higher than values for the Strait of Georgia and

considerably greater than estimates from the North Pacific. (Klein)
W77-12849

A PACKAGE OF COMPUTER PROGRAMS FOR BENTHIC COMMUNITY ANALYSIS,
Florida Univ., Gainesville. Dept. of Zoology.
For primary bibliographic entry see Field 7C.
W77-12850

THE ACCUMULATION, DISTRIBUTION, AND LOSS OF ZINC (65ZN) IN THE GASTROPOD VIVIPARUS ATER (CRISTOFORI AND JAN),
Commission of the European Communities. Ispra (Italy).
G. Pozzi, and M. Merlini.
Malacologia, Vol. 16, No. 1, p 227-230, 1977. 1 fig, 2 tab, 5 ref.

Descriptors: *Snails, *Gastropods, *Adsorption, *Zinc, *Metals, *Zinc radioisotopes, *Animal physiology, Radiochemical analysis, Radioisotopes, Mollusks, Invertebrates, Path of pollutants, Embryonic growth stage, Food chains, Predation, Distribution, Fish.
Identifiers: Viviparus ater, Bioaccumulation, Tissue analysis, Excretion, Lepomis gibbosus.

65ZN was accumulated primarily in the visceral mass and hepatopancreas of both sexes of the snail, Viviparus ater. The females transmitted the metal to the developing embryos. In 14 days the snails concentrated enough 65ZN in the soft tissues to substantially add to the radioactivity of their predator, the fish Lepomis gibbosus. (Klein)
W77-12851

POLYCHLORINATED BIPHENYLS IN THE HUDSON RIVER (HUDSON FALLS-FORT EDWARD, NEW YORK STATE),
Environmental Protection Agency, Edison, N. J. R. J. Nadeau, and R. A. Davis.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 4, p 436-444, 1976. 1 fig, 4 tab, 10 ref.

Descriptors: *Polychlorinated biphenyls, *Chlorinated hydrocarbon pesticides, *Path of pollutants, *Hudson River, Ecosystems, Food chains, Food webs, Water pollution, Sampling, Sediments, Biota, Water quality, Absorption, Chemistry, Rivers, Industrial wastes, Water pollution sources, Arochlor.
Identifiers: Biomagnification.

The presence and extent of contamination of water, sediments, and biota of the Hudson River by industrial use and discharge of PCB's were discussed. PCB's were ubiquitous in distribution within the Hudson River within a variety of substrates. Higher-than-background concentrations in the sediments and biota were found in the immediate vicinity of the PCB discharge. The adsorbed PCB's remained biologically active within the food web. A biomagnification pathway was indicated. The PCB's remained environmentally active and were not taken out of circulation by the geological sedimentation process. (Klein)
W77-12853

ACCUMULATION OF 14C-1-NAPHTHALENE BY AN OCEANIC AND AN ESTUARINE COPEPOD DURING LONG-TERM EXPOSURE TO LOW-LEVEL CONCENTRATIONS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
R. P. Harris, V. Berdugo, S. C. M. O'hara, and E. D. S. Corner.
Marine Biology, Vol. 42, p 187-195, 1977. 3 fig, 1 tab, 15 ref.

Descriptors: *Organic compounds, *Copepods, *Path of pollutants, *Radioisotopes, *Metabolism, *Animal physiology, *Tracers, Radioactivity,

Analytical techniques, Bioassay, Invertebrates, Oil pollution.
Identifiers: *Bioaccumulation, *Tissue analysis, *Naphthalene, Calanus helgolandicus, Eurytemora affinis.

In two species of marine zooplankton (Calanus helgolandicus and Eurytemora affinis) exposed to 14C-1-naphthalene, the body levels of radioactivity increased rapidly during the first few days of the exposure period, but after exposure for 7-8 days, an equilibrium condition was approached. Using a low concentration of hydrocarbon, the quantity of radioactivity accumulated after 10 days was found to be nearly fifty times greater in the smaller species, E. affinis, than in C. helgolandicus. After they had been exposed to the hydrocarbon for several days the copepods contained a considerable proportion of radioactivity that was no longer identifiable as naphthalene and was presumably present as metabolites. Radioactivity accumulated in the copepods after several days was rapidly lost after they were transferred to uncontaminated sea water. The results were discussed in terms of the possible transfer of hydrocarbon to a higher trophic level in areas subjected to constant low-level inputs of petroleum hydrocarbons. (Klein)
W77-12859

ELEMENTS IN AQUATIC MACROPHYTES, WATER, PLANKTON, AND SEDIMENTS SURVEYED IN THREE NORTH ISLAND LAKES,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
D. J. Rawlence.
New Zealand Journal of Marine and Freshwater Research, Vol. 11, No. 1, 1977, p 73-93. 1 fig, 6 tab, 40 ref.

Descriptors: *Metals, *Plankton, *Sediments, Aquatic plants, *Lakes, *Ions, Elements (Chemical), Sampling, Growth stages, Analytical techniques, Nutrients, Distribution, Chemical analysis, Water properties, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulfur, Sodium, Chlorine, Cobalt, Nickel, Silicon, Iron, Aluminum, Titanium, Vanadium, Chromium, Manganese, Zinc, Copper, Molybdenum, Strontium, Barium, Lead, Boron.
Identifiers: *New Zealand, Elodea canadensis, Lagarosiphon major, Gallium, Zirconium.

Surface water, plankton, sediments, and aquatic macrophytes were collected from three lakes on North Island, New Zealand and analyzed for 26 elements (N, P, K, Ca, Mg, S, Na, Cl, Co, Ni, Si, Al, Fe, Ti, V, Cr, Mn, Zn, Cu, Mo, Sr, Ba, Pb, B, Zr, Ba). Two species of macrophytes were sampled again three times during the year to provide data on variability within a single stand, and change in element content during different seasons and growth stages. The distribution of the elements was assessed in the three lakes. (Klein)
W77-12860

PLUTONIUM IN THE LAURENTIAN GREAT LAKES: FOOD-CHAIN RELATIONSHIPS,
Bureau of Sport Fisheries and Wildlife, Washington, D. C.
J. S. Marshall, B. J. Waller, and E. M. Yaguchi.
Verhandlungen International Vereinigung für theoretische und angewandte Limnologie, Vol. 19, p 323-329, 1975. 2 fig, 2 tab, 12 ref.

Descriptors: *Metals, *Sorption, *Path of pollutants, *Food chains, *Adsorption, Detritus, Ecosystems, Mode of action, Food webs, Analytical techniques, *Great Lakes, Fish, Phytoplankton, Sampling, Water quality, Zooplankton.
Identifiers: Bioaccumulation, *Plutonium, Mechanism of action.

The sorption of plutonium by phytoplankton and the subsequent settling of phytodetritus or zooplankton fecal pellets was thought to be a

major mechanism for removing plutonium from the Great Lakes waters. Results indicated that although the concentration of plutonium in phytoplankton was several thousand times that in water, it decreased by an order of magnitude in each successive link in the food chains leading to man. (Klein)
W77-12862

REVIEW PAPER: THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS AND CORRESPONDING MEASUREMENT PROCEDURES,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 5C.
W77-12865

USE OF A COLD-WATER REFUGE BY RAINBOW AND BROWN TROUT IN A GEOTHERMALLY HEATED STREAM,
Montana State Univ., Bozeman. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-12866

SOME HISTOLOGICAL AND HISTOCHEMICAL OBSERVATIONS ON THE TRANSFER OF TWO METALS (FE3+, CU2+) IN LYMNAEA (GALBA) TRUNCATULA MULLER (DONNEES HISTOLOGIQUES ET HISTOCHEMIQUES SUR LE TRANSFERT DE DEUX METAUX (FE3+, CU2+) CHEZ LYMNAEA (GALBA) TRUNCATULA MULLER), (IN FRENCH),
Limoges Univ. (France). Laboratoire d'Histologie-Embryologie-Cytogenetique.
D. Rondelaud, C. Chaisemartin, and D. Barthe.
Annales de Limnologie, Vol. 12, No. 3, p 269-281, 1976. 2 fig, 2 photos, 12 ref.

Descriptors: *Mollusks, Invertebrates, *Metals, *Copper, *Iron, *Path of pollutants, Metabolism, Absorption, Analytical techniques, Cytological studies, Animal physiology.
Identifiers: *Lymnaea truncatula, Tissue analysis, Histology, Excretion, Histochemistry.

The transfer processes of iron and copper in Lymnaea truncatula were examined by histochemical, histopathologic, and quantitative tests of Fe3+ and Cu2+ in the soft tissues. Iron penetrated the periteneal areas and the alimentary canal. This metal was excreted by 'dense cytoplasm cells' of the digestive gland and by ova of the genital gland. Periteneal areas were solely responsible for copper penetration. This metal was carried by 'amibocytes' and excreted in granules elaborated by 'digestive cells' of the digestive gland. (Klein)
W77-12867

MIREX AND MARINE UNICELLULAR ALGAE: ACCUMULATION, POPULATION GROWTH AND OXYGEN EVOLUTION,
Environmental Research Lab., Gulf Breeze, Fla.
For primary bibliographic entry see Field 5C.
W77-12870

MINIMAL DISSOLVED OXYGEN REQUIREMENTS OF AQUATIC LIFE WITH EMPHASIS ON CANADIAN SPECIES: A REVIEW,
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
For primary bibliographic entry see Field 5C.
W77-12871

CHARACTERISTICS OF SUSPENSIONS OF KUWAIT OIL AND COREXIT 7664 AND THEIR SHORT- AND LONG-TERM EFFECTS ON TISBE BULBISSETOSA (COPEPODA: HARPACTICOIDA),
Istituto di Biologia del Mare, Venice (Italy).
L. D. Venezia, and V. U. Fossato.
Marine Biology, Vol. 42, p 233-237, 1977. 4 fig, 2 tab, 18 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

Descriptors: Chemistry, *Analytical techniques, *Fuels, *Oil pollution, *Copepods, Organic compounds, Resistance, Toxicity, *Bioassay, Animal physiology, Reproduction, Invertebrates, Environmental effects, Laboratory tests, Gas chromatography, Fluorescence, Spectroscopy, Plankton.
Identifiers: *Tisbe bulbisetosa, *Kuwait oil, *Corexit 7664, Crude oil.

A technique for preparing seawater suspensions of Kuwait oil and Corexit was developed. The resulting hydrocarbon concentrations were analyzed by gas-chromatography and spectrofluorometric methods and the stability of the suspensions with time was determined. It was established that the suspensions have an effective stability from Days 3 to 15 after preparation, since in this period the concentration within a relatively narrow range. Adult female *Tisbe bulbisetosa* appeared to be quite tolerant of this type of hydrocarbon suspension, in short-term experiments, especially considering that the concentrations used in the bioassays were about 200 times higher than those measured in a relatively polluted area of the lagoon of Venice. Long-term effects on number of eggs produced, number of nauplii and hatching success for females of the third and fourth generations, subject to continuous exposure, were negligible compared with controls. (Klein)
W77-12872

EFFECTS OF WATER POLLUTED BY OIL ON AQUATIC ANIMALS IV. QUANTITATIVE DETERMINATION OF C14-C24 N-PARAFFINS IN MARINE SEDIMENTS AND SCALLOPS (PECTEN YESSOENSIS).
Hokkaido Univ., Hokkaido (Japan). Faculty of Fisheries.
For primary bibliographic entry see Field 5C.
W77-12877

MICROBIOLOGICAL STUDIES ON NITROGEN CYCLE IN AQUATIC ENVIRONMENTS 3. METABOLIC RATE OF AMMONIUM NITROGEN IN AERATED FISH CULTURE PONDS.
Kyoto Univ., (Japan). Research Inst. for Food Science.
A. Kawai, and M. Sugiyama.
Bulletin of the Research Institute for Food Science, Kyoto University, No. 40, p 1-6, 1977. 5 fig, 3 tab, 3 ref.

Descriptors: Water quality, *Sediments, *Mud, *Nitrogen, *Aeration, *Fish farming, *Ammonia, *Nitrogen cycle, Fish handling facilities, Metabolism, Carp, Microbiology, Aquaculture, Nitrites, Dissolved oxygen, Aerobic conditions.

The role of aeration in fish culture ponds from a microbiological standpoint was investigated using aquaria with bottom mud and water collected from a carp culture pond. The qualities of water and mud of the aquaria with and without aeration were investigated. The rate of nitrogen metabolism was estimated. The metabolic rate of ammonium nitrogen as well as rates of the incorporation into microbial cells and of the oxidation toward nitrite increased by aeration. (Klein)
W77-12878

UPPER BAY SURVEY, VOL. II. TECHNICAL REPORT.
Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.
For primary bibliographic entry see Field 5A.
W77-12880

UPPER BAY SURVEY, VOL. III. AUTOMATED DATA PROCESSING AND SUPPLEMENTARY DATA.
Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.
For primary bibliographic entry see Field 5A.

W77-12881

CRITERIA DOCUMENT FOR PCB'S,
Massachusetts Audubon Society, Lincoln.
For primary bibliographic entry see Field 5A.
W77-12882

ANIMAL FEEDING FACTORIES AND THE ENVIRONMENT: A SUMMARY OF FEEDLOT POLLUTION, FEDERAL CONTROLS, AND OKLAHOMA LAW.
For primary bibliographic entry see Field 5G.
W77-12888

NUTRIENTS IN ALBERMARLE SOUND, NORTH CAROLINA.
North Carolina State Univ. at Raleigh. Dept. of Zoology.
W. B. Bowden, and J. E. Hobbie.
Sea Grant Publication No. UNC-SG-75-25, April 1977. 199 p, 87 fig, 15 ref, 2 append. SG-04-3-158-40.

Descriptors: *Nutrients, *Eutrophication, *Water quality, *Baseline studies, *North Carolina, Sounds.
Identifiers: *Albemarle Sound(NC).

The quality of water and degree of eutrophication were measured in Albemarle Sound, a large oligohaline sound in North Carolina. The patterns of nutrient concentration over time in Albemarle Sound were similar to those found in the near-by Tar-Pamlico and Neuse River systems, with some exceptions. Although nutrients seen to be abundant, algal bloom conditions were surprisingly infrequent. At present the sound is healthy with few signs of excessive eutrophication. However, the Albemarle Sound watershed is a rapidly developing region. Increased non-point source pollution from second-home developments or reduced turbidity as a result of dams could rapidly accelerate the eutrophication process in this system. (NOAA)
W77-12912

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 9. OIL SPILLS: PROBLEMS AND OPPORTUNITIES.
Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
For primary bibliographic entry see Field 5G.
W77-12917

STATUS OF ALTERNATIVE SYSTEMS FOR SEPTIC WASTES DISPOSAL IN NORTH CAROLINA.
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 5E.
W77-12962

THE DECOMPOSITION RATE OF ORGANIC MATTER OF STEPHANODISCUS HANTZSCHII GRUN. FROM THE CHANNEL OF THE NORTHERN DONETS BASIN, (IN RUSSIAN).
Central Control Research Project, Donetsk (USSR). Research Water Lab.
A. I. Kovrizhnykh, S. P. Maksimova, and M. I. Gerasimenko.
Gidrobiol Zh 12(4), p 72-75, 1976.

Descriptors: *Decomposing organic matter, Water temperature, Oxidation.
Identifiers: *Stephanodiscus-hantzschii, Temperature, *USSR(Donets Basin).

S. hantzschii is the principle producer of organic material in the channel of the northern Donets basin (USSR). Experiments showed that at 20-22°C the oxidation of easily-available *S. hantzschii* organic matter occurred in 7-10 days, during which 78% of the organic matter was decomposed. At

10°C this process was less intensive and lasted for over 20 days. —Copyright 1977, Biological Abstracts, Inc.
W77-12971

HYDROBIOLOGICAL RESEARCH RELATED TO LARGE SCALE EXPERIMENTAL POLLUTION STUDIES IN THE RANCE ESTUARY: PRIMARY PRODUCTION IN RELATION TO CERTAIN PHYSICO-CHEMICAL PARAMETERS, (IN FRENCH).
Museum National d'Histoire Naturelle, Paris (France). Laboratoire de Physiologie Generale et Comparee.
For primary bibliographic entry see Field 5C.
W77-12975

PRELIMINARY ANALYSIS ON THE DISTRIBUTION OF PORIFERA IN AREAS EXPOSED TO DIFFERENT TYPES OF POLLUTION, (IN ITALIAN).
Genoa Univ. (Italy). Inst. of Zoology.
M. Pansini, and R. Pronzato.
Boll Mus Ist Biol Univ Genova 43, 21-32, 1975.

Descriptors: *Path of pollutants, *Distribution, Water pollution sources, Bioindicators, Sewage, Industrial wastes.
Identifiers: Calcispongiae, Demospongiae, Hymeniacidon-sanguinea, *Porifera, Italy(Liguria Coast).

The effects of several kinds of pollution on the distribution of Porifera were analyzed along the coast of Liguria (Italy). five stations on hard bottoms subjected to industrial or cloacal pollution and another from unpolluted waters were selected. The number of Porifera collected in polluted waters is lower than in unpolluted environments, but the industrial pollution seems to affect the sponge development much more than the sewage. Only 3 specimens of Calcispongiae and 2 of Demospongiae (owing to different species) were collected in polluted waters containing parts of toxic chemicals. A rather rich and varied population of Porifera (8 spp.) was observed in the harbor eutrophic environment, despite the presence of considerable amounts of sewage. The numerous findings of the Demospongia Hymeniacidon sanguinea (Grant) in polluted water emphasize the interest of the study of this sponge as a possible pollution marker. —Copyright 1977, Biological Abstracts, Inc.
W77-12976

ZOOPLANKTON OF THE DNIESTER ESTUARY AND ADJACENT SEASIDE UNDER ANTHROPOGENIC INFLUENCES, (IN RUSSIAN).
Institute of Biology of the Southern Seas, Odessa (USSR).
L. N. Polishchuk.
Gidrobiol Zh 12(6), p 37-45, 1976.

Descriptors: *Zooplankton, *Estuaries, Water pollution effects, Agricultural runoff, *Marine life.
Identifiers: *USSR(Dniester estuary).

Reduction in the Dniester river (Ukrainian SSR, USSR) runoff and the construction of a canal resulted in significant changes in the biological state of the estuary. Intrusion of marine fauna increased, but the number of the fresh-water fauna representatives decreased. The number of marine immigrants is especially high in periods of low precipitation. Quantitative changes also took place: the amount of zooplankton in summer was 6 times as low as in the 1950's. In the marine areas adjacent to the estuary both quantitative and qualitative changes in zooplankton occur. The changes are due mostly to increased eutrophication of the Black Sea northwestern shelf by river waters oversaturated with organic substances from industrial, agricultural and domestic waste. —Copyright 1977, Biological Abstracts, Inc.

W77-12977

HEAVY-METAL POLLUTION OF ELBE RIVER SEDIMENTS, (IN GERMAN),
Kiel Univ. (West Germany). Institut fuer Pflanzenernährung und Bodenkunde.
For primary bibliographic entry see Field 5A.
W77-12978

STUDIES ON COASTAL OCEANOGRAPHY IN TANOURA BAY, IZU PENINSULA (1975-1974), (IN JAPANESE),
Nihon Univ., Tokyo. Coll. of Agriculture and Veterinary Science.
K. Yoshihara, M. Shyunichi, M. Koko, K. Takatori, and S. Hidea.
Bull. Coll. Agric. Vet. Med. Nihon Univ. 33, p. 450-467, 1976.

Descriptors: Bays, Oceanography, Nitrogen, Oxygen, Seasonal, Chlorination, Water temperature, Water pollution, Nitrates, Dissolved oxygen.
Identifiers: *Japan (Tanoura Bay).

The coastal oceanographic conditions in Tanoura Bay, Shimoda, Shizuoka prefecture (Japan) were surveyed from Dec. 1973-Dec. 1974, to obtain oceanographic data in relation to marine organisms. Surveyed were water temperature, chlorinity, dissolved O₂, saturation percentage of dissolved O₂, ammonia-N, nitrate-N, nitrite-N and silicate-Si. The seasonal water temperature showed almost the same fluctuations at the 6 locations observed. The largest diurnal range of water temperature occurred in Aug. (about 4.0 degrees C) and the annual range was 16.1 degrees C. The chlorinity in spring and summer was much lower than in autumn and winter. The values of dissolved O₂ were highest in May and lowest in Sept. at each station. The saturation percentage of dissolved O₂ decreased from Dec.-April, and suddenly increased in May, showing the highest value at each station. The lowest values were found in Sept. The value of nitrate-N was highest in Nov. The values of nitrite-N increased and decreased at regular intervals of 3 or 4 mo. The largest tidal range was observed in Feb. (1.7 m). The role of the tide in diurnal changes of water conditions is uncertain.—Copyright 1977, Biological Abstracts, Inc.
W77-12980

STUDIES OF THE CAUSES OF FISH MORTALITY IN LAKE BALATON IN 1975, (IN HUNGARIAN),
Mem. Novenyvedelmi Kozpont (Hungary). Vizelettani Lab.
B. Penzes.
Allattani Kozl. 63(1-4), p. 123-130, 1976.

Descriptors: *Fish diseases, Lakes, Pesticide residues, *Fishkills, Diatoms, Water pollution effects.
Identifiers: *Lake Balaton (Hungary).

Fish mortality in Lake Balaton (Hungary) in 1975 was studied in 4 directions; external examination of dead and moribund fishes, analysis of the brain, adipose tissue, liver and muscle of the fish with particular interest in pesticide content, analysis of local water quality, and a study of the harmful effect of Diatomaceae present in the area at risk. Fish mortality was not due to any disease, poisoning, or change in the chemical composition of Balaton lake water. Instead the mass mortality of the fish was due to a great increase in Diatomaceae (Chrysophyta). An important increase in the organism *Nitzschia avicularis* had occurred. The needle-shaped algae with elongated bodies and hard siliceous scales entered the gills of the fish, where they played a decisive mechanical role in respiration and destroyed the sensitive branchial epithelium until the fishes suffocated.—Copyright 1977, Biological Abstracts, Inc.
W77-12981

EXPERIMENTAL MODELING AND MATHEMATICAL DESCRIPTION OF RADIONUCLIDE METABOLISM IN THE SYSTEM 'AQUEOUS MEDIUM-HYDROBIONTS', (IN RUSSIAN),
Nauchno-Issledovatel'skii Inst. Radiatsionnoi Gigieny, Leningrad (USSR).
S. Ya. Sukal'skaya, and I. A. Likhtarev.
Gidrobiol. Zh. 12(4), p. 55-62, 1976.

Descriptors: *Model studies, Aquaria, *Biomass, *Radioisotopes, *Distribution, Radioecology, *Metabolism, Mathematical models.

Any expedient but fixed ratio of water and biomass volumes can be used in aquarium (model) experiments for estimation of the parameters characterizing the transport of radionuclides in the system. A conversion coefficient is proposed which allows the values of exchange parameters obtained experimentally to be used for analysis and prediction of radionuclide distribution in the real radioecological systems. The calculation of radionuclide exchange parameters in similar system may be conducted on the basis of the principles of chamber analysis.—Copyright 1977, Biological Abstracts, Inc.
W77-12993

5C. Effects Of Pollution

NITROGEN RECYCLING IN THE CHOWAN RIVER,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
D. W. Stanley, and J. E. Hobbie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 643.
Price codes: A07 in paper copy, A01 in microfiche.
North Carolina Water Resources Research Institute, Raleigh, UNC-WRRI Report No. 121, March 1977. 127 p., 20 fig., 4 tab., 52 ref., 7 append.
OWRT B-077-NC(1), 14-31-0001-5097.

Descriptors: *Nitrogen, *Recycling, Algae, Runoff, Light, Biomass, Temperature, Photosynthesis, Estuaries, *Eutrophication, *North Carolina, Organic wastes, Cyanophyta, Dinoflagellates, Chlorophyta, Productivity, Phytoplankton.
Identifiers: *Chowan River-Albemarle Sound (NC), *Nitrogen recycling.

The lower Chowan River, located in northeastern N.C., is actually a freshwater tidal estuary emptying into Albemarle Sound. Dissolved inorganic nitrogen concentrations in the Chowan are high in winter and low in summer. This pattern results from a combination of high rates of input from land runoff in the winter and high rates of removal by rapidly growing algae in the summer. Dissolved organic nitrogen is the most abundant form of nitrogen in the river, and the concentrations decrease downriver, suggesting that it is transformed to other forms within the river. Annual algal production in the river was around 100 g C.m⁻², over 90% of which occurred between May and October, a period when blue-green, dinoflagellate and green algae made up most of the algal biomass. Annual inorganic nitrogen uptake, measured by 15N isotope techniques, was 33 g NH₄-N.m⁻² and 12 g NO₃-N.m⁻². Carbon-nitrogen ratios calculated from these data are low, probably because of nitrogen assimilation by bacteria in the samples and because of luxury uptake of nitrogen by the phytoplankton. During winter rapid flushing rates, low light intensities and low temperatures are the most important factors limiting algal photosynthesis and nitrogen uptake in the river. During summer inorganic nitrogen became limiting as nitrate and ammonia levels fell below 50 g N.liter⁻¹, the concentration found necessary for maximum uptake. However, rapid regeneration of ammonia permitted rapid algal growth throughout the summer despite the low concentrations. (Kiger NC State)
W77-12252

THE DISTRIBUTION OF TOXIC METALS IN MARINE ECOSYSTEMS AS A RESULT OF SEWAGE DISPOSAL AND NATURAL PROCESSES,
Duke Univ., Beaufort, N.C. Marine Lab.
For primary bibliographic entry see Field 5B.
W77-12253

LAND AND RECREATIONAL DEVELOPMENT AT NEW JERSEY RESERVOIRS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Science.
For primary bibliographic entry see Field 6G.
W77-12257

EFFECTS OF DISEASES AND PARASITES ON FISH POPULATIONS OF THE UPPER SHETUCKET RIVER WATERSHED,
Connecticut Univ., Storrs. Inst. of Water Resources.
C. N. Burke, L. R. Penner, and W. R. Whitworth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 712.
Price codes: A02 in paper copy, A01 in microfiche.
Research Project Technical Completion Report, August 1977. 15p., 11 tab. OWRT A-065-CONN(1), 14-31-0001-6007.

Descriptors: *Fish diseases, *Fish parasites, *Fish populations, *Growth rates, Water quality, *Correlation analysis, Age, Rivers, Impoundments, *Bass, *Connecticut, Bioindicators, *Suckers.
Identifiers: *River water quality indicators, *White sucker, *Upper Shetucket River Watershed (Conn).

An evaluation of the frequency and intensity of parasites and lesions of largemouth bass and white sucker populations in three impoundments in the upper Shetucket River Watershed, Connecticut, revealed differences between the three impoundments. No significant differences in the growth of white sucker in two of the impoundments and lower growth rates of bass in one impoundment were noted; one impoundment could not be evaluated. The inability to provide correlations between incidence and intensity of diseases and parasites and growth of either species prohibited any valid comparison with variability of the quality of water in the three sampling areas. This data record will serve as a guideline for future studies attempting to monitor water quality changes. The measurement of differences in stress on fish populations, as evidenced by disease, parasites, and growth rate changes, could be compared to these data and used to indicate water quality improvements. (deLara-Conn)
W77-12258

LONG-TERM BIOTOXICITY OF CHLORINE SPECIES TO COPEPOD POPULATIONS,
Maryland Univ. Baltimore County, Baltimore. Dept. of Biological Sciences.
B. P. Bradley.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 622.
Price codes: A02 in paper copy, A01 in microfiche.
Water Resources Research Center, University of Maryland, College Park, Technical Report No. 42, (1977). 16 p., 7 tab., 15 ref. OWRT A-037-MD(1), 14-34-0001-6021.

Descriptors: Water pollution effects, *Chlorine, *Copepods, *Toxicity, *Bioassay, Reproduction, Mortality, Organic compounds.
Identifiers: *Eurytemora affinis*, *Acartia tonsa*, Survival.

A test for tolerance of copepods to chlorine was developed. This assay was useful if the animals were not to be used for breeding. Chlorination seemed to have subtle effects even at sublethal levels. Animals which seemed completely recovered from chlorine shock would nevertheless

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

not produce offspring. A major general conclusion was that the ultimate effect of chlorination was not always clear from death rates or even from egg production. Hence, although 100ppb seemed to be an acceptable level of residual chlorine judging by the negligible number of deaths of copepods at 24 hr, the acceptable level in terms of the survival of mature offspring was probably much lower. This may have been due to the greater death rate among pre-adult stages compared to adult stages. Some work on a chlorine-containing organic compound indicated that harmful effects on copepods did not occur below concentrations of the compound which were orders of magnitude above normal environmental levels.

W77-12260

OXYGEN REQUIREMENTS OF EMBRYOS AND LARVAE OF THE LARGEMOUTH BASS, MICROPTERUS SALMOIDES (LACEPEDE), Environmental Research Lab.-Duluth, Minn. W. A. Spoor.

Journal of Fish Biology, Vol. 11, No. 2, p 77-86, 1977. 1 fig, 5 tab, 20 ref.

Descriptors: *Bass, *Sunfishes, *Embryonic growth stage, *Larval growth stage, *Oxygen requirements, *Toxicity, Fish physiology, Mode of action, Growth stages, Resistance, Fish behavior, Mortality, Respiration, Oxygen demand, Laboratory tests, Life history studies.

Starting with the second day after fertilization, largemouth bass embryos and larvae became increasingly sensitive to oxygen deficiency until the sixth day of life. On this day few survived exposure to 1 mg O₂/l for 3 h at 20°C; many were damaged at 2 mg/l, but not at 2.5. Death was by asphyxiation or by starvation resulting from an apparent inability to close the lower jaw. On the seventh day the larvae became more resistant again, possibly because opercular movement began on that day. At 25°C the effects of reduced oxygen concentration were intensified, and even a concentration of 2.5 mg/l became lethal in 3 h. At 3 mg O₂/l and 20 degrees the normally quiescent yolk-sac larvae became very active and swam vertically to at least 5 or 6 cm above the substrate; 4 and 5 mg/l had this effect at 23-24 degrees. This behaviour could result in losses by predation and displacement from the nest. (Klein)

W77-12275

IMPROVED BYPASS AND COLLECTION SYSTEM FOR PROTECTION OF JUVENILE SALMON AND STEELHEAD TROUT AT LOWER GRANITE DAM, National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.

For primary bibliographic entry see Field 81. W77-12276

BIOGENIC MEROMIXIS AND STABILITY IN A SOFT-WATER LAKE, Washington Univ., Seattle. Dept. of Zoology. For primary bibliographic entry see Field 2H. W77-12319

EFFECTS OF TOW TRAFFIC ON THE RESUSPENSION OF SEDIMENTS AND ON DISSOLVED OXYGEN CONCENTRATIONS IN THE ILLINOIS AND UPPER MISSISSIPPI RIVERS UNDER NORMAL POOL CONDITIONS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Engineering Effects Lab. J. H. Johnson.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 617. Price codes: A09 in paper copy, A01 in microfiche. Technical Report Y-76-1, May 1976. 181 p, 47 fig, 6 tab, 23 ref, 6 append.

Descriptors: *Oxygen demand, *Ponds, *Mississippi river, Sediment transport, Suspended load, Suspended solids, Suspension, Sedimentation, Environmental effects, Water pollution effects. Identifiers: *Illinois River, Resuspension, Tow traffic.

In total, 19 separate tows were monitored on the Mississippi River and 21 tows on the Illinois River at locations chosen to correspond to upper, middle, and lower river reaches. Specific sampling sites were selected so that maximum effects (changes in concentrations) of tow traffic on potentially productive side channel habitats could be tested. The analyses indicated that tow traffic on the Illinois and Upper Mississippi Rivers during normal pool conditions does contribute to existing levels of suspended sediment measured as both suspended solids and turbidity, and, furthermore, that sediments resuspended from the main channel do move laterally to shoreward areas, including potentially productive side channel areas. Based on the relative responses of suspended solids concentrations and turbidity levels following the passage of tow traffic on both the Illinois and Upper Mississippi Rivers, the Illinois River appears to be more susceptible to tow traffic effects than the Mississippi River appears to be. Comparison of past studies made during periods of high flow with the present study made during normal pool conditions, however, indicated that tow-generated turbidity levels in the Mississippi River are smaller than natural turbidity levels occurring during annual flood stage conditions. Information collected about each tow (size, speed, draft, direction of travel, horsepower, and type—single or multiple) was examined and compared with elicited responses to see if any relationship existed. Although there were some apparent relationships, no clear predictive patterns were evident from inspection of the data because of the complexity of the problem and the lack of control of the traffic monitored. (Lee-ISWS)

W77-12331

PROTOZOA AS TEST ORGANISMS FOR THE EVALUATION OF THE PROPERTIES OF EFFLUENTS (PROSTEISHIE MIKROORGANIZMY KAK TEST-OB'EKTY DLYA OTSENKI SVOISTV STOCHNYKH VOD),

For primary bibliographic entry see Field 5A. W77-12349

LIMNOLOGICAL STUDIES ON THE THREE DAMMED LAKES, CONSTRUCTED IN THE WATERCOURSE OF THE MONOBE RIVER, KOCHI PREFECTURE, (IN JAPANESE), I. Morishita.

Jpn J Limnol 37(1), p 23-28, 1976.

Descriptors: *Limnology, Lakes, Reservoirs, Rivers, Surveys, Plankton, *Diatoms, Benthos, Dinoflagellates, *Eutrophication, *Diptera. Identifiers: Chironomus plumosus, Chroococcus limneticus, Cryptochironomus sp, Cymbella tumida, Melosira varians, Peridinium willei, Phaenopsectra sp, Synedra ulna, *Japan(Monobe River).

Three reservoirs on the Monobe River (Japan) were surveyed in July 1973 and Feb.-March 1974. The rate of water exchange is low in the Nagase Reservoir and high in the other Sugita and Yoshino, both of which have no thermal stratification and have retention time less than 2 h. In July the plankton of the Nagase Reservoir is considerably different from the other 2. In the former, Chroococcus limneticus (blue-green alga) and Synedra ulna (diatom) are dominant. In the Sugita and the Yoshino Reservoirs 2 dominant diatoms, Melosira varians and Cymbella tumida are found, both of which seem to have come from the flora attached to the upper river bed. The 2 reservoirs have no plankton in the lower reaches, because the turnover water turnover is too rapid. In Feb. the

plankton of the lower 2 lake is the same as that of the upper lake, though Peridinium willei did not occur in the lower 2 lakes. This dinoflagellate makes the water red in the Nagase Reservoir in March. Nagase, Sugita and Yoshino Reservoirs were investigated in 1973 with regard to their benthos. Chironomus plumosus characteristic of eutrophic lakes, was abundant on the bottom of Nagase Reservoir. Cryptochironomus sp. and Phaenopsectra sp., both of which are characteristic species of mesotrophic lakes, were found on the bottom of Sugita and Yoshino Reservoirs.—Copyright 1977, Biological Abstracts, Inc. W77-12364

A COMMUNITY DEVELOPER'S ROLE IN ENVIRONMENTAL PLANNING AND MONITORING,

Soil Conservation Service, Lincoln, Nebr. Midwest Technical Service Center. K. A. Alverson, and W. H. Wilcox. Journal of Soil and Water Conservation, Vol. 32, No. 4, p 183-185, July-August, 1977.

Descriptors: *Environmental effects, *Planning, *Water quality, *Monitoring, Water quality standards, Environmental control, Waste water treatment, Waste disposal, Estuaries. Identifiers: Port Charlotte(FL), Environmental consulting agencies.

Operations of the Environmental Quality Laboratory Incorporated, a private environmental consulting laboratory in Port Charlotte, Florida, are described. Federal and state regulations have required potential developers to submit environmental impact statements in advance of new projects and to design developments which meet environmental criteria. The Environmental Quality Laboratory was established in 1975 by the General Development Corporation to aid developers and planners in meeting these requirements. Laboratory facilities include two chemistry labs, a biology lab, a bacteriology lab, a library, and a computer room. The services provided by Environmental Quality Laboratory include compliance monitoring, environmental planning of new community developments, and redesigning of older plans for residential communities. The laboratory also conducts a monitoring program of Charlotte Harbor, Florida, which includes regular evaluations of water quality and biota. The laboratory is currently testing new methods of waste disposal and treatment for the Port Charlotte area. (Schulz-FRL)

W77-12396

THE EFFECTS OF NTA ON THE CHLORINE DEMAND OF VARIOUS TYPES OF WATER, Environmental Protection Agency, Narragansett, R.I. Northeastern Water Supply Lab. E. L. Katz.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 363. Price codes: A03 in paper copy, A01 in microfiche. Technical Report, July 1, 1971. 28 p, 12 tab.

Descriptors: *Chlorination, *Nitrilotriacetic acid, *Chemical wastes, *Model studies, Potable water, Surface waters, Temperature, Hydrogen ion concentration, Chemical reactions, Disinfection, Water treatment, Waste water treatment, *Chlorine.

The effects of NTA (tri-sodium salt of nitrilotriacetic acid, N-(CH₂COONa)₃) on chlorine demand of potable and surface waters were examined. Chlorine demand was also examined for different chlorine concentrations, NTA concentrations, NTA types, temperature, pH, and contact time. Increases in chlorine demand caused by the presence of NTA were higher at higher temperatures in tests from 4°C to 23°C. NTA also increased chlorine demand more effectively at lower pH's. An increase in NTA concentration from 1 to 25 ppm increased chlorine de-

mand by a factor of 2 or more. Studies indicated that the effect of NTA was increased with chlorine contact time, increasing by up to 6% in 0 to 4 hours contact time. No discernible difference in increased chlorine was observed between commercial NTA and re-crystallized NTA. The report concluded that at high temperatures, high NTA concentrations, and acidic pH, NTA may increase chlorine demand by as much as 50%. (Schulz-Firl)

W77-12480

LAND USE AND WATER QUALITY IN THE FLATHEAD DRAINAGE,
Montana Univ., Flathead Lake. Biological Station.
For primary bibliographic entry see Field 5B.
W77-12582

NORTHERN GREAT PLAINS RESOURCES PROGRAM: WATER QUALITY SUBGROUP REPORT,
Northern Great Plains Resources Program, Denver, Colo.
J. Shaw, and J. Hardaway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 607.
Price codes: A99 in paper copy, A01 in microfiche.
Discussion draft, Prepared for Environmental Protection Agency, August 1974, 530 p.

Descriptors: *Great Plains, *Water quality, *Coal mines, *Energy, *Water use, Surface water, Ground water, Power plants, Chemical analysis, Agriculture, Fish, Cooling water, Limnology, Trace elements, Missouri River(ND).
Identifiers: Yellowstone River, Bighorn River, Tongue River, Powder River, Cheyenne River, Bell Fourche River, Little Missouri River, Heart River, Knife River, Cannonball River.

This study assesses the possible impacts of coal and related development upon the quality of the waters in the Northern Great Plains (NGP). The major Basins in the study area include the mainstem of the Yellowstone, the mainstem of the Missouri in North Dakota, the Bighorn, Tongue, Powder, Cheyenne, Belle Fourche, Little Missouri, Heart, Knife, and Cannonball River Basins. The study assesses the present water quality of the streams most likely to be affected by coal development, the needs for water use in coal development, the water quality influences associated with development, the projected changes in water quality should coal development occur, and the existing ground water quality in the area. The critical areas where existing data are insufficient for adequate analysis are identified. These critical areas are important because they show where new data should be collected to insure that any development proceeds with minimum adverse impacts, both in the short and long term. This study was produced by one of seven work groups created by the Northern Great Plains Resources Board to assess environmental quality, mined area reclamation, development of other mineral resources, and the effects of coal development on the people and economics of the region. (Nessan-NC)

W77-12588

PRIMARY PRODUCTION AND CHLOROPHYLL CONTENT IN THE BALTIC SEA: PART II. CHLOROPHYLL-A DISTRIBUTION,
Morski Instytut Rybacki, Gdynia (Poland). Dept. of Oceanography.
H. Renk.
Pol Arch Hydrobiol. Vol. 20(2), No. 4, p 237-255, 1973.

Descriptors: *Primary productivity, *Chlorophyll, Eutrophication, Estuaries, Phytoplankton, *Distribution, Rivers.
Identifiers: *Baltic Sea.

The vertical distribution of chlorophyll in waters of the Baltic Sea varied within the annual cycle. During the spring and summer time, content of the euphotic layer was higher than that of the deeper waters, whereas in autumn and winter, no essential differences in chlorophyll concentrations were found at any of the various depths within the investigated water layer down to 50 m depth. In the Gdansk Deep, seasonal differences in chlorophyll concentrations were observed which in 1971 were caused by 2 phytoplankton blooms, the one in April, the other in November. During the two cruises to the Baltic, May 20-June 19 and September 7-October 1, 1971, the following statements were made. In the area of the southern Baltic, the regions from the Bornholm Deep in west, through the Slupsk Furrow to the Gdansk Deep in east were characterized by chlorophyll concentrations amounting to 2 mg/m³ in spring. The inshore waters of the western Baltic situated far away of estuaries were in the spring season of 1971 characterized by lower chlorophyll concentrations than the offshore waters. In close vicinity of the estuaries of large rivers high concentrations of chlorophyll were observed which gradually decreased toward the open sea. In the Gulf of Finland, the chlorophyll concentrations were higher than the mean for the open Baltic Sea. At the end of the spring, the most of the central Baltic area showed the chlorophyll concentrations to be nearly uniform and amounting to about 1.5 mg/m³. In September 1971, the surface waters of the northern part of the Gotland Deep had chlorophyll concentrations ranging from 2-3 mg/m³.—Copyright 1974, Biological Abstracts, Inc.
W77-12591

THE BIOLOGY OF DAPHNIA MAGNA STRAUS AND THE PRODUCTION OF ITS POPULATION IN LAKE BUGAEVO (KRASNOYARSK KRAI), (IN RUSSIAN),
Siberian Research Inst. of the Fish Industry, Krasnoyarsk (USSR), Krasnoyarsk Div.
For primary bibliographic entry see Field 2H.
W77-12616

UPTAKE OF CHLORO- AND BROMOBIPHENYLS, HEXACHLORO- AND HEXABROMOBENZENE BY FISH,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
V. Zitko, and O. Hutzinger.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 6, p. 665-673, 1976. 1 fig, 6 tab, 7 ref.

Descriptors: *Organic compounds, *Halogens, *Chlorine, *Bromine, Chemistry, Fish, *Absorption, *Salmonids, *Atlantic salmon, Metabolism, Mode of action, Water quality, Analytical techniques, Laboratory tests, Mortality.
Identifiers: *Biphenyls, *Benzene, *Brominated hydrocarbons, Bioaccumulation, Tissue analysis, Chloro biphenyls, Bromobiphenyls, Hexachlorobenzene, Hexabromobenzene.

No major differences between the accumulation of di- and tetra-, bromo- and chlorobiphenyls by Atlantic salmon (*Salmo salar*) was apparent. In contrast to hexachlorobenzene, hexabromobenzene was not accumulated either from water or from food. The concentration of both chloro- and bromo- substituted compounds in water was of the same order of magnitude, and in both cases fish accumulated higher concentration from water than from food. In both groups of compounds, the accumulation coefficients generally decreased with increasing degree of substitution during the uptake from water, and increased with increasing degree of substitution when taken up from food. Of the dihalobiphenyls, the 3,4-isome accumulated from water much less than 2,6- and 2,4-dihalobiphenyl, and did not accumulate from food. Partially debrominated compounds were not detectable in fish exposed either from water or

from food, but a dibromobiphenyl was tentatively detected in the former. Mortality after exposure to chlorine occurred among fish fed the mixture of brominated hydrocarbons and their toxicity should be further studied. (Katz)
W77-12636

ORGANISM AND ENVIRONMENT ON POLLUTED BEACHES: A CANONICAL CORRELATION ANALYSIS,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland).
P. Read, and T. Renshaw.
The Journal of Applied Ecology, Vol. 14, p. 31-42, 1977. 6 tab, 6 ref.

Descriptors: *Wildlife, *Distribution patterns, Statistics, *Beaches, *Deposition(Sediments), *Speciation, *Sediments, *Correlation analysis, *Intertidal areas, Varieties, Particle size, Biomass, Statistical methods, Surveys, Sampling, Methodology, *Domestic wastes, Water pollution effects.
Identifiers: *Canonical correlation analysis, *Scolecipis fuliginosa*, *Spio filicornis*, *Eteone longa*.

The relationship between beach conditions and the variety and abundance of intertidal macrofauna on beaches in different states of pollution were investigated. Exploration of the nexus linking species with sediment was carried out using the statistical method of canonical correlation analysis. On the most heavily polluted beach two contrasting features of the macrofaunal community were apparent: *Scolecipis fuliginosa* and *Spio filicornis* formed a substantial part of the biomass and were associated with finer sediments, whereas *Eteone longa* contributed less to the biomass and was associated with coarser sediments of lower organic content. Beach characteristics and the species associated with them were largely specific to the individual beaches along a pollution gradient. An outline description of the observed nexus was given. (Katz)
W77-12637

COPPER TOXICITY IN THE PACIFIC OYSTER CRASSOSTREA GIGAS,
California Univ., Bodega Bay. Bodega Marine Lab.
R. K. Okazaki.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 6, p. 658-664, 1976. 1 fig, 3 tab, 15 ref.

Descriptors: *Metals, *Copper, *Toxicity, *Lethal limit, *Oysters, Mollusks, Invertebrates, Path of pollutants, Metabolism, Animal physiology, Mortality, Resistance, Bioassay, Animal behaviour.
Identifiers: *Pacific oyster, Bioaccumulation.

The toxicity levels of Cu²⁺ for the Pacific oyster, *Crassostrea gigas*, were determined. The 96-hr TLm was estimated to be 0.56 ppm. However, at 1.00 ppm exposure, oyster mortality averaged 67% for the three 96-hr tests. Thus, the TLm was believed to represent the upper limit of response to lower but lethal concentrations of Cu²⁺. It was suggested that Cu²⁺ at high concentrations may be chemically different to that existing at lower concentrations, the metal may be precipitating out at a faster rate at 1.00 ppm, and the oyster may be able to sense this form and cease feeding by closing their valves. Preliminary experiments showed 100% survival of oysters exposed to Cu²⁺ levels of 5.6 and 7.5 ppm for 96 hr. The length of exposure was indicated critical since Cu²⁺ uptake was a cumulative process which may eventually overwhelm or slowly damage regulatory mechanisms and sites of accumulation in the tissues. (Katz)
W77-12638

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

TOXICITY OF WATER-SOLUBLE FRACTIONS OF NO. 2 FUEL OIL AND SOUTH LOUISIANA CRUDE OIL TO SELECTED STAGES IN THE LIFE HISTORY OF THE POLYCHAETE, NEANTHES ARENACEODENTATA, Texas A and M Univ., College Station. Dept. of Biology. S. S. Rossi, and J. W. Anderson. Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 1, p. 18-24, 1976. 1 fig, 2 tab, 20 ref.

Descriptors: *Fuels, *Oil pollution, *Toxicity, *Life history studies, *Worms, *Resistance, Chemistry, Path of pollutants, Metabolism, Growth stages, Oil pollution, Invertebrates, Organic compounds, Lethal limit, Oil spills. Identifiers: *Polychaetes, Neanthes arenaceodentata, No. 2 fuel oil, South Louisiana crude oil, Bioaccumulation.

The results of bioassays concerning the toxicity of petroleum hydrocarbons (PHCs) on 4 juvenile and 2 adult stages of Neanthes arenaceodentata indicated that significant differences in sensitivity exist among life stages. Young stages of N. arenaceodentata exhibited a high tolerance of PHCs. (Katz) W77-12639

CONTRIBUTION TO THE STUDY OF DRINKING WATER, DANUBE WATER AND BIOCEANOSE CONTAMINATION WITH CHLORINATED INSECTICIDES, Ustav Hygieny, Bratislava (Czechoslovakia). M. Sackmauerova, O. Palusova, and A. Szokolay. Water Research, Vol. 11, p. 551-556, 1977. 5 fig, 27 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, Water quality, *DDT, *DDE, Insecticides, Organic compounds, Water pollution, Rivers, Surface waters, Potable water, Path of pollutants, Fish, Freshwater fish, Toxicity, Aquatic plants, Sediments, Sampling, Chromatograph, Carp, Sunfish, Pikes, Perches. Identifiers: Bioaccumulation, Biocenose Contamination, Danube River, Benzene hexachloride, BHC.

Methods are presented of determination of BHC isomers, of DDE, DDT and HCB in water, drinking and surface waters from the Danube; in two sorts of fish living in the Danube: herbivorous (Cyprinus carpio L., Abramis ballerus L. and Chondrostoma nasus L.) and carnivorous (Esox lucius L., Lepomis gibbosus L., Aspius aspius L. and Perca fluviatilis L.); in sediment and water plants using GLC and TLC. In the period 1971-1974, the mean concentrations of the compounds studied were: in drinking water from 0.00 to 0.12 micro g/l; in the waters from the Danube from 0.006 to 0.197 micro g/l; in predominantly herbivorous fish from 0.00 to 0.190 mg/kg; in carnivorous fish from 0.00 to 2.58 mg/kg; in sediment from 0.01 to 2.11 mg/kg; and in water plants from 0.002 to 0.032 mg/kg. The mean levels of the studied compounds found in the fish were 1000-10,000 times higher than those of the water. Comparing the average contents of the BHC isomers as well as of DDT and DDE in fish, considerably higher concentrations of DDE and DDT were found as compared with the BHC levels, mainly in carnivorous fish. Differences in the contents of the insecticides studied are due to their different cumulative properties. (Katz) W77-12640

EFFECTS OF SUBLETHAL CONCENTRATIONS OF CADMIUM ON ADULT PALAEMONETES PUGIO UNDER STATIC AND FLOW-THROUGH CONDITIONS, South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research; and South Carolina Univ., Columbia. Dept. of Biology.

W. B. Vernberg, P. J. DeCoursey, M. Kelly, and D. M. Johns. Bulletin of Environmental Contamination and Toxicology, Vol. 17, No. 1, p. 16-24, 1977. 5 fig, 1 tab, 12 ref.

Descriptors: *Shrimp, *Metals, *Bioindicators, *Mortality, *Toxicity, Salinity, *Cadmium, Bioassay, Design, Crustaceans, Respiration, Path of pollutants, Laboratory tests, Growth stages, Resistance, Methodology, Laboratory equipment. Identifiers: *Palaemonetes pugio, *Bioaccumulation, *Grass shrimp, Flow-through systems, Static systems, Tissue accumulation.

To establish a uniform bioassay procedure for sublethal concentrations of cadmium in a typical estuarine species, a series of studies was carried out with the grass shrimp Palaemonetes pugio, a common euryhaline estuarine species with a wide distributional range from Massachusetts to the Gulf Coast. Survival, molting time and metabolism were the measurement parameters for adult male grass shrimp maintained under different thermal-salinity regimes in either a static or a flow-through system, using CdCl₂ at different concentration levels as the toxicant. Mortality for shrimp under control conditions in the static system was very low in all salinities. The increased mortality of the cadmium-exposed shrimp was related to the salinity regime; as salinities decreased mortality increased. Tissue accumulation of cadmium under both static and flow-through conditions was proportional to salinity at 25C. At 15C, less cadmium was concentrated than at 25C in both systems, but shrimp in the flow-through system accumulated much more of the metal. At high body burden levels cadmium inhibited molting; at more moderate levels molting was stimulated. Respiratory rates were found to be unpredictable and unreliable indicators of cadmium pollution. Data obtained from a flow-through system was indicated to be more applicable to field studies than data based on a static system. P. pugio was found to be too resistant and tolerant a species to be of value for short-term bioassay studies on cadmium. (Katz) W77-12641

THE EXPOSURE OF AMMONIA TO THE PHOTODISSOCIATED HEMOGLOBIN OF THE MARINE BLOODWORM, GLYCERA DIBRANCHIATA, Rhode Island Univ., Kingston. Dept. of Animal Science. R. J. Sousa, T. L. Meade, and G. T. Felbeck, Jr. Comparative Biochemistry and Physiology, Vol. 58A, p. 19-22, 1977. 2 fig, 1 tab, 19 ref.

Descriptors: *Analytical techniques, *Organic compounds, *Ammonia, Animal physiology, *Biochemistry, *Worms, Cytological studies, Chemical reactions, Biological properties, Mode of action, Aquatic life, Benthic fauna. Identifiers: *Bloodworms, Glycera dibranchiata, Hemoglobin, Photodissociation, Tissue analysis.

Ammonia was injected into an anaerobic reaction chamber containing non-liganded hemoglobin (from the bloodworm, Glycera dibranchiata) obtained by employing a photolytic technique to dissociate carbon monoxide from the hemoglobin molecule. No major alteration of the absorbance spectrum was effected after exposure to ammonia and only after subsequent contact with air did a spectral change become apparent. This lends support to the contention that ammonia does not substantially exert a competitive effect with oxygen for the 6th coordinate position of the hemoglobin molecule. (Katz) W77-12642

THE ROLE OF DISPERSION IN FUEL OIL BIOASSAY, Battelle Pacific Northwest Labs., Richland, Wash. Marine Research Lab.; and Battelle-Seattle Research Center, Wash.

For primary bibliographic entry see Field 5A. W77-12643

PHYSICAL MODEL OF MARINE PHYTOPLANKTON CHLORINATION AT COASTAL POWER PLANTS, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5B. W77-12645

POSSIBLE EFFECT OF LEAD ON EGG-SHELL THICKNESS IN KESTRELS 1874-1974, Copenhagen Univ. (Denmark). Inst. of Hygiene. P. Grandjean. Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 1, 1976. 2 fig, 3 tab, 14 ref.

Descriptors: Metals, *Heavy metals, *Lead, *Water birds, *Bird eggs, *Path of pollutants, *Dimensions, *Measurement, Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, Toxicity, DDE, Dieldrin. Identifiers: *Kestrels, Egg-shell thickness, Bioaccumulation, Tissue analysis, Falco tinnunculus.

A correlation between lead concentration in old egg-shells and shell thickness was indicated. The same correlation appeared between the lead concentration and shell thickness of recent eggs which also contained chlorinated hydrocarbons. The organochlorine concentrations were strongly interrelated, but PCB was the only residue which correlates significantly to the lead concentration in the shells. (Klein) W77-12646

ACUTE EFFECTS OF METHYL MERCURY TOXICITY IN CHANNEL CATFISH (ICTALURUS PUNCTATUS) LIVER, Nevada Univ., Reno. Dept. of Anatomy. M. W. Kendall. Bulletin of Environmental Contamination and Toxicology, Vol. 18, No. 2, p. 143-151, 1977. 12 fig, 1 tab, 23 ref, 1 plate.

Descriptors: *Organic compounds, *Chlorine, *Mercury, *Channel catfish, Fish physiology, *Mode of action, *Toxicity, Lethal limit, Catfishes, Toxins, Absorption, Path of pollutants, Environmental effects, Metals. Identifiers: *Histology, *Methyl mercuric chloride, *Fish liver, Bioaccumulation, Tissue analysis.

The sequential toxic effects in catfish liver produced by an acute LD50 dosage of an organic mercurial compound (methyl mercuric chloride) was investigated. Mercury analysis data revealed high uptake and increasing concentration of mercury in livers from 24-96 hrs. At 24 hrs the CH₃HgCl treated fish showed greatly distended abdomens and when these were excised, revealed a reddish-yellow, serous exudate. This fluid increased over the experimental time period. At 72 and 96 hrs livers revealed blanched necrotic foci on their outer capsular surfaces. Bile accumulation was remarkable since the gall bladder was greatly distended with copious amounts of biliary fluid. Numerous histological alterations were noticed and described. (Katz) W77-12647

THE EFFECT OF EXPOSURE TO A SUBACUTE CONCENTRATION OF PARATHION ON THE GENERAL LOCOMOTOR BEHAVIOR OF THE GOLDFISH, Texas A and M Univ., College Station. Dept. of Biology. G. M. Rand. Bulletin of Environmental Contamination and Toxicology, Vol. 18, No. 2, p. 259-266, 1977. 3 fig, 1 tab, 20 ref.

Descriptors: *Fish behavior, Fish physiology, Organic compounds, *Toxicity, *Organophosphorous compounds, Mortality, Lethal limit, Bioassay, Phosphorous compounds, Path of pollutants, Mode of action, Pesticides, *Phosphothioate pesticides, Bioassay.
Identifiers: *Goldfish, Bioaccumulation, Tissue analysis, Carassius auratus, Locomotor behavior.

Exposure to parathion to goldfish (*Carassius auratus*) resulted in an overall decline in activity. Untreated fish displayed an orientation distribution characterized by a preponderance of small angles. After parathion exposure the distribution was modified and distinguished by a shift in magnitude to larger angles, suggesting that parathion exposure may affect motor control mechanisms such as the control of a neural 'retention' mechanism and other fish behavior patterns involving locomotion. (Katz)

W77-12648

EFFECTS OF FUEL OIL ON SEA CATFISH: FEEDING ACTIVITY AND CARDIAC RESPONSES.

Texas Univ. of Austin, Dept. of Zoology.
R. T. Wang, and J. A. C. Nicol.
Bulletin of Environmental Contamination and Toxicology, Vol 18, No 2, p 170-176, 1977. 2 fig, 2 tab, 20 ref.

Descriptors: *Catfishes, *Oil, *Fuels, *Toxicity, *Mortality, *Fish behavior, *Fish physiology, *Food habits, Lethal limit, Mode of action, Path of pollutants, Organic compounds, Animal pathology.
Identifiers: *Sea catfish, *Arius felis*, Cardiac response, Feeding behavior, Tissue analysis, No L fuel oil.

The effects of No. 2 fuel oil on survival, feeding behavior and heart rate of sea catfish (*Arius felis*) were investigated. The LC50 for 96 h was 0.14 ml/l. Prior to death there was much damage to surface tissue. At 0.038 ml/l, feeding responses of catfishes deteriorated and the fish could not retain their food. Several minutes after adding fuel oil the heart rate slowed. Threshold was at 0.01 ml/l; at 0.1 ml/l bradycardia was pronounced and behavior of some fish was affected. (Katz)

W77-12649

EFFECTS OF POLYCHLORINATED BIPHENYL AND A POLYCHLORINATED DIBENZOFURAN ON MOLTING OF THE FIDDLER CRAB, UCA PUGILATOR.

Tulane Univ., New Orleans, La. Dept. of Biology.
S. W. Fingerman, and M. Fingerman.
Bulletin of Environmental Contamination and Toxicology, Vol. 18, No. 2, p. 138-142, 1977. 2 fig, 10 ref.

Descriptors: *Crabs, *Crustaceans, *Polychlorinated biphenyls, *Chlorinated hydrocarbon pesticides, *Organic compounds, *Shellfish, *Animal physiology, *Aroclors, Invertebrates, Water pollution sources, Path of pollutants, Mode of action, Growth stages.
Identifiers: *Aroclor 1242, *Fiddler crab, *Uca pugnator*, *Polychlorinated dibenzofuran, Molting, Bioaccumulation.

Aroclor 1242 drastically inhibited the rate of molting of fiddler crabs lacking either the eyestalks or four walking legs. Aroclor 1242 completely inhibited ecdysis among the eyestalkless crabs. However, the OCDF produced only relatively slight inhibition of the rate of molting. It was highly likely that only a very small proportion of the inhibition caused by Aroclor 1242 would have been due to PCDF contaminants. Whereas by the end of the experiments with the Aroclor, the ratio of the percent ecdysis of the eyestalkless crabs in the Aroclor to that of the control crabs was 0.00 and the corresponding ratio for the crabs lacking four walking legs was 0.21, the ratios derived from

the OCDF experiments were 0.77 for the eyestalkless crabs and 0.89 for the crabs lacking four walking legs. The vast proportion of the inhibition of molting activity in the fiddler crab produced by Aroclor 1242 appeared due to the PCB itself and not to the small quantity of PCDFs that were contaminants in Aroclors. (Katz)

W77-12650

THE SHORT-TERM TOXICITY OF SOME FEED ADDITIVES TO DIFFERENT FRESH-WATER ORGANISMS.

Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab for Toxicology.
J. H. Canton, and G. J. van Esch.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 6, p. 720-725, 1976. 4 tab, 7 ref.

Descriptors: *Toxicity, *Organic compounds, *Freshwater fish, *Aquatic organisms, *Algae, *Crustaceans, *Feeds, Rainbow trout, Salmonids, *Daphnia*, *Chlorella*, Lethal limit, Bioassay, Metabolism, Environmental effects, Water pollution sources, Path of pollutants.
Identifiers: Bioaccumulation, *Feed additives, *Chlorella pyrenoidosa*, *Daphnia magna*, *Lebistes reticulatus*, *Salmo gairdneri*, Robenidine, Stenerol, Pyrimethamine, Amprolium, Ethopabate, Furazolidone, Zoalene.

The short-term toxicity (EC50 respectively LC50 after 2 or 4 days) of 13 feed additives was determined to 4 freshwater organisms of different trophical levels: *Chlorella pyrenoidosa*, *Daphnia magna*, *Lebistes reticulatus* and *Salmo gairdneri*. The most toxic (LC(EC)50 < 1 mg/l) were robenidine (to all tested organisms) and stenerol (to *Daphnia*); moderately toxic (1 < LC(EC)50 < 1 mg/l) was pyrimethamine. Amprolium, ethopabate, furazolidone and zoalene proved to be little toxic (LC(EC)50 > 10 mg/l); whereas buquinolate, carbadox, clopidol, decoquinolate, grofas and sulfaquinoxaline were under the experimental conditions not toxic for the tested organisms. (Katz)

W77-12651

THE TOXICITY OF AMMONIUM MOLYBDATE TO MARINE INVERTEBRATES.

University of Strathclyde, Dumbartonshire (Scotland), Marine Lab.
O. J. Abbott.
Marine Pollution Bulletin, Vol. 8, No. 9, p. 204-205, 1977. 1 tab, 6 ref.

Descriptors: *Toxicity, *Molybdenum, *Industrial wastes, *Ammonium compounds, *Chemical wastes, Marine microorganisms, Invertebrates, Water quality standards, Environmental effects, Crabs, Water pollution sources, Effluents, Bioassay.
Identifiers: *Carcinus*, *Asterias*.

Molybdenum occurs naturally in seawater as molybdate ion, but little is known of its effects, at elevated concentrations, upon marine organisms. The toxicity of ammonium molybdate, a constituent of some industrial wastes, to marine invertebrates has now been tested. It proves to be not very toxic. (Katz)

W77-12653

TRACE METALS IN FINFISH FROM THE NEW YORK BIGHT AND LONG ISLAND SOUND.

National Marine Fisheries Service, Milford, Conn. Milford Lab.
For primary bibliographic entry see Field 5B.
W77-12654

TOXIC CHEMICALS IN CANADIAN FISH-EATING BIRDS.

Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 5B.
W77-12655

FURTHER STUDIES UPON A STEEL WORKS EFFLUENT.

University of Strathclyde, Dumbartonshire (Scotland), Marine Lab.
For primary bibliographic entry see Field 5B.
W77-12656

EFFECTS OF TEMPERATURE AND RATION LEVEL ON THE GROWTH AND FOOD CONVERSION EFFICIENCY OF SALMO GAIKNERI, RICHARDSON.

Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
W. A. Wurtsbaugh, and G. E. Davis.
Journal of Fish Biology, Vol. 11, p. 87-98, 1977. 4 fig, 2 tab, 37 ref.

Descriptors: *Water temperature, *Metabolism, *Growth rates, *Rainbow trout, *Salmonids, *Food habits, Fish physiology, Fish behavior, Heated water, Juvenile growth stage, Mode of action, Environmental effects, Aquaculture.
Identifiers: Food conversion rate, Ration level.

The effects of temperature and ration size on the growth rate and gross efficiency of food conversion of juvenile rainbow trout were evaluated during 25-day seasonal experiments. Rations ranged from near-starvation to repletion levels. Test temperatures were 3 and 6°C higher than the controls which fluctuated dielily and seasonally. At rations near maintenance, elevated temperatures decreased trout growth. As the feeding rate increased the detrimental effect of temperature on growth was ameliorated. At repletion feeding levels, elevated temperature up to 17°C improved trout growth by increasing the maximum food consumption rate. With a temperature increase from 6.9 to 22.5°C maintenance rations increased from 2.2 to 7.5% body weight per day. Gross efficiency was dependent upon ration level and temperature. As the food consumption rate increased, efficiency increased to a maximum, then generally declined at repletion levels. Elevated temperatures resulted in reduced efficiencies at low consumption rates but temperatures had little effect at high ration levels. A field study provided estimates of the food consumption relationships established in the laboratory, suggested any substantial increase of stream temperature without a concomitant increase of food abundance would result in decreased trout production. (Klein)

W77-12657

EFFECTS OF HYPERCAPNIA ON THE BUFFER CAPACITY AND HAEMATOLOGICAL VALUES IN SALMO SALAR (L.).

Uppsala Univ. (Sweden). Inst. of Zoophysiology.
H. Borgeson.
Journal of Fish Biology, Vol. 11, p. 133-142, 1977. 2 fig, 4 tab, 33 ref.

Descriptors: *Fish physiology, Chemistry, *Carbon dioxide, Chlorides, Ions, Hydrogen ion concentration, Respiration, Metabolism, Salmonids, Salmon, Analytical techniques, Environmental effects, Biochemistry, Atlantic salmon.
Identifiers: *Hypercapnia, Buffers, Haematology, Fish blood, Tissue analysis, Buffer capacity, Fish blood.

The effects of high environmental carbon dioxide tension (PCO2) on buffering status, pH, haematocrit, red blood cell (RBC) count, mean corpuscle volume (MCV), and chloride (CL-) distribution in the blood of young salmon were investigated after 30 min and 24 h. An increase in blood buffering capacity was observed after 24 h. As compared to the preacclimation situation, haematocrit, RBC, MCV, and CL- content of the erythrocytes increased after 30 min but decreased if hypercapnia was sustained for 24 h. However the plasma bicarbonate (HCO3-) content increased over the whole experimental period. Plasma CL- content was decreased after 24 h, but the ratio of CL- between erythrocytes and plasma increased at

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

the onset of hypercapnia, then remained unchanged during the rest of the investigation period. (Klein)
W77-12658

SURVIVAL OF TWO BACTERIAL FISH PATHOGENS (AEROMONAS SALMONICIDA AND THE ENTERIC REDMOUTH BACTERIUM) IN OZONATED, CHLORINATED, AND UNTREATED WATERS.
Bureau of Sport Fisheries and Wildlife, Seattle, Wash. Western Fish Disease Lab.
G. A. Wedemeyer, and N. C. Nelson.
Journal of the Fisheries Research Board of Canada, Vol 34, 1977, p 429-432. 2 fig, 8 ref.

Descriptors: Microorganisms, Oxygen, *Ozone, *Chlorine, *Chlorination, Freshwater, Pathology, *Pathogenic bacteria, *Sterilant, *Fish diseases, *Aquaculture, Fish hatcheries, Public health, *Bacteria, Bactericides, Hardness (Water).
Identifiers: Fish pathogens, Aeromonas salmonicida, Enteric redmouth bacterium, Chlorine residual, *Furunculosis.

Ozone and chlorine inactivation curves were determined in three water types at 20°C for the destruction of the fish pathogens *Aeromonas salmonicida*, the etiologic agent of furunculosis, and the enteric redmouth bacterium (ERM). In phosphate-buffered distilled water, 0.01 mg/l ozone inactivated 10(3) cells/ml ERM and *A. salmonicida* in 1/2 and 10 min, respectively. Chlorine at this concentration had little effect on either pathogen and a residual of at least 0.05 mg/l was needed to achieve a complete kill within a 10-min contact time. In soft lake water (30 mg/l as CaCO₃) a chlorine residual of 0.1 mg/l rapidly (1/2-min) inactivated *A. salmonicida* and ERM but in hard water (120 mg/l) *A. salmonicida* was more resistant and 0.2 mg/l chlorine was required. Ozonation of the two lake waters at 90 mg O₃ h⁻¹ liter⁻¹ (equivalent to a 0.01 mg/l residual in ozone demand-free water) was required to destroy both pathogens within 10 min. In untreated soft lake water 10(3) cells/ml of *A. salmonicida* survived only 2 days, while the ERM bacterium (10(3) cells/ml) survived even after 20 days in soft and hard untreated lake waters. (Katz)
W77-12659

EFFECT OF SALINITY FLUCTUATION ON THE OSMOTIC PRESSURE AND Na⁺, Ca²⁺ AND Mg²⁺ ION CONCENTRATIONS IN THE HEMOLYMPH OF BIVALVE MOLLUSCS.
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Biology Unit.
S. E. Shumway.
Marine Biology, Vol. 41, p 153-177, 1977. 11 fig, 1 tab, 46 ref.

Descriptors: *Invertebrates, *Mollusks, *Salinity, *Animal physiology, *Ions, *Osmotic pressure, *Calcium, *Magnesium, *Sodium, Alkali metals, Metals, Water properties, Chemical properties, Analytical techniques, Bioassay.
Identifiers: Bivalves, Hemolymph, Mantle fluid, Tissue analysis.

Bivalve mollusks were exposed to both gradual and abrupt salinity fluctuations and measurements were made of osmotic, Na⁺, Mg²⁺, and Ca²⁺ concentrations in the hemolymph and where applicable in the mantle fluid. The hemolymph and mantle fluid osmotic Na⁺, Mg²⁺, and Ca²⁺ concentrations of most species followed those of the external medium as long as the mollusc's shell valves remained open. There were no changes in the ionic or osmotic concentrations of the hemolymph or mantle fluid of any of these species during periods of shell-valve closure. All of the species studied were shown to be osmoconformers. (Klein)
W77-12660

TOXICITY AND ACCUMULATION OF THE INSECTICIDE IMIDAN IN FRESHWATER INVERTEBRATES AND FISHES.
Fish and Wildlife Service, Columbia, Mo. Fish Pesticide Research Lab.
A. M. Jolin, and H. O. Sanders.
Transactions of the American Fisheries Society, Vol. 106, (4), 1977, p 386-392. 8 tab, 23 ref.

Descriptors: *Bioassay, *Toxicity, Mortality, Freshwater fishes, Invertebrates, *Pesticides, *Insecticides, Benthos, *Organophosphorus compounds, Organophosphorus pesticides, Amphipods, Crustaceans, Aquatic insects, *Chinook, *Bass, *Channel catfish, *Rainbow trout, Fish eggs, Juvenile stages, *Hydrogen ion concentration.
Identifiers: *Imidan, Smallmouth bass, Larval midges, Chironomus, Eyed eggs, Yolk-sac fry.

Toxicity tests showed that aquatic invertebrates and fish have a broad range of sensitivities to Imidan, an organophosphate insecticide. Invertebrate 48-h EC₅₀'s (concentration immobilizing 50% of the test organisms) or LC₅₀'s (concentration lethal to 50% of the test organisms) ranged from 2.4 microg/liter for amphipods (*Gammarus pseudolimnaeus*) to 3,200 microg/liter for larval midges (*Chironomus plumosus*). Among fish tested, chinook salmon and smallmouth bass were the most sensitive (96-h LC₅₀, 150 microg/liter) and channel catfish the most resistant (96-h LC₅₀, 11,000 microg/liter). Toxicities of the active ingredient to fishes were similar for the technical grade Imidan and the 50% wettable powder formulation. Toxicities to fish increased with the increasing temperature and decreasing pH, but were unaffected by water hardness. Eyed eggs and yolk-sac fry of rainbow trout were more resistant to Imidan than were fingerlings. Aging of Imidan in water of 20°C and pH 7.2 decreased its toxicity. Four-day-old solutions were less than 0.04 as toxic as fresh solutions. Seven species of aquatic invertebrates and three species of fish exposed to 14C-Imidan in slightly alkaline water accumulated radioactive residues in 48 h that ranged from 1 to 10 times (based on wet weight of whole organism) the water concentration of 1.2 plus or minus 0.2 microg/liter. (Katz)
W77-12661

SOME EFFECTS OF TEMPERATURE AND SALINITY ON LABORATORY-REARED EGGS AND LARVAE OF POLYDACTYLUS SEXFILIS (PICES: POLYNEMIDAE).
Hawaii Inst. of Marine Biology, Honolulu.
M. T. Santerre, and R. C. May.
Aquaculture, Vol. 10, p 341-351, 1977. 3 tab, 5 fig, 20 ref.

Descriptors: *Water temperature, *Salinity, *Growth rates, *Larval growth stage, Commercial fish, *Aquaculture, *Environmental effects, *Fish eggs, *Hatching, Hawaii, Temperature, Marine fish.
Identifiers: *Polydactylus sexfilis*, Survival, Moi.

The effects of temperature and salinity on eggs, yolk-sac larvae and developmental rates of *Polydactylus sexfilis* are presented. Larval length at 95% yolk-sac absorption was maximized between 23.8 and 28.6°C. Larvae were judged capable of feeding before the yolk was completely absorbed. Larvae incubated at intermediate temperatures also had larger amounts of yolk remaining when eyes and jaws were judged functional. In 34 parts per thousand seawater, normalized larval survival at the end of the yolk-sac stage was greater than 50% between temperatures of 21.9 and 28.0°C. Larval survival decreased at lower temperatures and salinities. Proportions of abnormal larvae increased at temperature and salinity extremes, and normal development was maximized between 26 and 34 parts per thousand. Larvae (74h after fertilization) were more tolerant to extreme high temperatures than were newly fertilized eggs. Upper salinity tolerance limits of 42 h larvae were greater

at 26.2°C than at 23.5 or 29.2°C, and lower salinity was less tolerated at the two extreme temperatures. Recommended temperatures and salinities for rearing *P. sexfilis* eggs and early larvae are 24-28°C and 26-34 parts per thousand. (Katz)
W77-12662

SURVIVAL AND GROWTH OF BIVALVE LARVAE UNDER HEAVY-METAL STRESS.
National Marine Fisheries Service, Milford, Conn. Milford Lab.
A. Calabrese, J. R. MacInnes, D. A. Nelson, and J. E. Miller.
Marine Biology, Vol. 41, p 179-184, 1977. 1 fig, 3 tab, 20 ref.

Descriptors: Invertebrates, *Mollusks, *Clams, *Oysters, *Growth rates, *Toxicity, Larvae, *Larval growth stages, *Lethal limit, Metals, *Heavy metals, Shellfish, Water pollution effects, Mercury, Copper, Nickel, Zinc, Growth stages, Metabolism, Inorganic compounds, Resistance, Stress, Path of pollutants, Bioassay.
Identifiers: Survival rates, American oyster, Hard clam, Bioaccumulation, Silver, *Crassostrea virginica*, *Mercenaria mercenaria*.

In a study of the toxicity of mercury, silver, copper, nickel, and zinc to larvae of the American oyster *Crassostrea virginica* and hard clam *Mercenaria mercenaria*, the concentrations at which 5% (LC₅), 50% (LC₅₀), and 95% (LC₉₅) of the larvae died were determined, as well as growth at the LC₅ and LC₅₀ values. The order of toxicity for oyster larvae was Hg-Ag-Cu-Ni, and for clam larvae Hg-Cu-Ag-Zn-Ni. Growth of larvae of both species, with the exception of clam larvae in nickel-treated water, was not reduced at the LC₅ values, but was markedly reduced at the LC₅₀ values. (Klein)
W77-12663

ACID MINE DRAINAGE, A BIBLIOGRAPHY WITH ABSTRACTS.
National Technical Information Service, Springfield, Va.
For primary bibliographic entry see Field 5G.
W77-12664

THE RELATIONSHIP BETWEEN THE SMALL ALGAL FLORA OF THE CHAIN OF SHALLOW INLETS TO THE SOUTH OF DARSS (SOUTH BALTIC) AND THE QUALITY OF THESE WATERS, (IN GERMAN).
Rostock Univ. (East Germany). Dept. of Biology.
H. Pankow, and B. Martens.
Wiss Z Univ Rostock Math-Naturwiss Reihe 22(10), p 1147-1152, 1973.

Descriptors: *Algae, Inlets, *Salinity, Water pollution effects, Eutrophication.
Identifiers: *Baltic Sea, Darss, East Germany, *Saprobity.

Investigations of the microalgae during 1970-1973 shows that all shallow inlets to the S of Darss and Zingst (southern Baltic), (East Germany) occupy a median position between the oligosaprobic and the beta-mesosaprobic stages. The pollution is greatest in the western part (particularly in the Saaler Bodden). It decreases towards the E. The simultaneous effects of 2 ecological factors (saprobity and salinity) are discussed.—Copyright 1976, Biological Abstracts, Inc.
W77-12717

MANAGING SALINE WATER FOR IRRIGATION.
International Center for Arid and Semi-Arid Land Studies, Lubbock, Tex.
For primary bibliographic entry see Field 3C.
W77-12726

STUDIES ON PLOVER COVE RESERVOIR, HONG KONG III. A COMPARISON OF THE SPECIES COMPOSITION OF DIATOM FLORAS ON DIFFERENT SUBSTRATES, AND THE EFFECTS OF ENVIRONMENTAL FACTORS ON THEIR GROWTH.

Hong Kong Univ. Dept. of Botany.
I. J. Hodgkiss, and Y. C. Tai.
Freshwater Biology, Vol 6, No 3, p 287-298, 1976.
10 fig, 3 tab, 31 ref.

Descriptors: Biological communities, *Distribution patterns, *Growth rates, *Speciation, Ecosystems, *Diatoms, Chlorophyll, Cytological studies, Environmental effects, Metabolism, Productivity, Population, Plant growth, Microorganisms, Aquatic plants, Plankton, Seasonal.
Identifiers: *Hong Kong.

The species composition and year-month frequency together with the abundance of the four periphytic communities of Plover Cove Reservoir (the epiphyton, epilithon, epipelon and episammon) were compared both in terms of all species present and in terms of major (dominant/frequent) species using the 'circle' method. All four communities were similar in terms of overall species composition but the richest variety of species occurred in the epiphyton. The diatom floras on wood and rock surfaces closely resembled each other as did the two sand grain floras. The relationships between the growth of these four periphytic diatom communities and the physical and chemical conditions were also investigated, in terms of cell number and chlorophyll content. Both graphical and statistical analysis of the results were discussed, and it was suggested that fluctuations in water level, temperature and nutrients (especially silicate and phosphate) were the major factors governing the seasonal patterns of variation in periphyton standing crop. (Katz)
W77-12783

THE EFFECT OF LABORATORY CONDITIONS ON THE EXTRAPOLATION OF EXPERIMENTAL MEASUREMENTS TO THE ECOLOGY OF MARINE ZOOPLANKTON, II. EFFECT OF OXYGEN SATURATION ON THE RESPIRATION RATE.

Rosentiel School of Marine and Atmospheric Science, Miami, Fla.
T. Ikeda.
Bulletin of the Plankton Society of Japan, Vol 24, No 1, p 19-28, 1977. 4 fig, 2 tab, 17 ref.

Descriptors: *Zooplankton, *Respiration, *Oxygen, *Oxygen demand, *Oxygen requirements, Animal physiology, Oxygenation, Plankton, Aquatic life, Aquatic animals, Dissolved oxygen, Laboratory tests, Water quality, Crustaceans, Saturation, Methodology.
Identifiers: *Oxygen saturation, Boreal zooplankton, Subtropical zooplankton, Euphausia sp., Cyphocaris sp., Parathemisto sp., Holmesiella sp., Calanus sp., Sagitta sp., Undinula sp., Euchaeta sp., Acartia sp., Arrow worms.

The relationship between respiration rate and degree of oxygen saturation of water was examined in boreal zooplankton species (Euphausia pacifica, Cyphocaris challengeri, Parathemisto pacifica, Holmesiella anomala, Calanus pacificus, C. plumchris, and Sagitta hispida). As an index, the percentage of oxygen saturation at which the respiration rate of animals decreased to 50% of the rate at saturation, P50, was used. No distinct relation was observed between body size or weight specific respiration rate of species and P50. However, species with high respiration rates were more affected by low oxygen concentration. Generally, animals which inhabit oxygen-rich environments were more sensitive to low oxygen levels. About 70-80% saturation was suggested as a general limit above which the respiration rate of zooplankton is little affected by ambient oxygen concentration, though there were a few exceptions. (Klein)
W77-12784

UPPER BAY SURVEY, VOL. I. EXECUTIVE SUMMARY.
Westinghouse Ocean Research Lab., Annapolis, Md.
For primary bibliographic entry see Field 5B.
W77-12785

UPPER BAY SURVEY VOL. IV. NUMERICAL MODELING.
Westinghouse Oceanic Div., Annapolis, Md.
For primary bibliographic entry see Field 5B.
W77-12786

THE SHORT-TERM EFFECTS OF LEAD ON DOMESTIC AND WILD ANIMALS.
Environmental Research Lab., Corvallis, Oreg.
R. P. Botts.

Ecological Research Series, Report EPA-600/3-77-009, January 1977. 29 p, 11 fig, 1 tab, 87 ref.

Descriptors: *Lead, *Metals, Public health, *Animal diseases, *Animal pathology, Animal physiology, Toxicity, *Domestic animals, Path of pollutants, Chemical analysis, Laboratory tests, Cattle, Review.
Identifiers: *Lead poisoning, *Animal nutrition, Veterinary medicine, *Lead intoxication, *Lead toxicosis, Sources of lead, Toxic levels, Sign, Symptom, Diagnosis, Clinical pathology, Wild animals.

Small quantities of lead may be found in practically all species of plants and animals. The list of animals, both domestic and wild, reportedly intoxicated by lead is impressive. The sources of lead poisoning vary with species of animals. Lead base paints, used motor oils, spend lead shot and pastures contaminated by lead smelters seemingly have been most often incriminated. The lesions associated with lead intoxication may vary widely both within and between species of animals. Lesions and symptoms of the central nervous system are the most prominent. Toxic levels for various species as reported in the literature vary widely and seemingly a single toxic dose for each species, as yet, has not been definitely established. The diagnosis and treatment of lead intoxication may become laborious and time consuming. Most symptoms, reported involve central nervous system dearrangement. Treatment of most clinical cases is disappointing generally because of the acute nature of lead poisoning. (Katz)
W77-12787

HEALTH EFFECTS OF ACID AEROSOLS.
National Environmental Research Center, Research Triangle Park.
For primary bibliographic entry see Field 5A.
W77-12813

TOXICITY OF CHLORPYRIFOS TO MALLARD DUCKS.
San Diego State Univ., Calif. Dept. of Biology.
S. H. Hurlbert.
Bulletin of Environmental Contamination and Toxicology, Vol. 17, No. 1, p 105-107, 1977. 6 ref.

Descriptors: *Organic compounds, *Mortality, *Path of pollutants, *Toxicity, *Toxins, Chlorinated hydrocarbon pesticides, Organophosphorus compounds, Ducks, Mallard Ducks, Laboratory tests, Wildlife, Bioassay, *Methodology.
Identifiers: *Chlorpyrifos, Polemic.

Mallard ducks from chlorpyrifos (DURBAN)-treated ponds incurred a 42% mortality rate opposed to a 0% mortality rate on control ponds. Arguments were given refuting an earlier paper's critique on the effects of DURBAN. (Klein)
W77-12845

THE EFFECT OF STABLE DISSOLVED-OXYGEN STRESS ON MARINE BENTHIC INVERTEBRATE COMMUNITY DIVERSITY.
Southeastern Massachusetts Univ., North Dartmouth, Dept. of Biology.
For primary bibliographic entry see Field 5B.
W77-12846

LEVELS OF CHLORINATED HYDROCARBONS IN EGGS OF DOUBLE-CRESTED CORMORANTS FROM 1971-1975.
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5B.
W77-12847

FACTORS INFLUENCING THE TOXICITY AND ANIMAL SUSCEPTIBILITY OF ANABAENA FLOS-AQUAE (CYANOPHYTA) BLOOMS.
Alberta Univ., Edmonton, Dept. of Botany.
W. W. Carmichael, and P. R. Gorham.
Journal of Phycology, Vol. 13, p 97-101, 1977. 1 fig, 5 tab, 18 ref.

Descriptors: *Toxicity, *Resistance, *Cyanophyta, *Aquatic algae, *Bacteria, *Toxins, *Animals, *Algal poisoning, *Algal toxins, Lethal limit, Mortality, Biomass, Animal physiology, Domestic animals, Anabaena.
Identifiers: Anabaena flos-aquae, *Toxic algal blooms, Toxic algae.

Biological factors have been found which can cause variable toxicity of colony and clonal isolates of Anabaena flos-aquae when cultured in the laboratory. Two bacteria in the Enterobacteriaceae isolated from a toxic waterbloom, depressed toxin production in selected bacteria-free toxic clones of A. flos-aquae. These toxin-depressing bacteria decreased culture toxicity 3-fold from 80 to 240 mg/kg (intraperitoneal in male mice). Many colony isolates from a toxic bloom had minimum lethal dosages greater than 240 mg/kg. This was because they were composed of mixtures of toxic and nontoxic filaments. The oral LD₅₀ of the toxin from A. flos-aquae clonal isolate NRC-44-1 varied significantly for 6 different animal species. Using these oral LD₅₀ it is estimated that a surface-concentrated bloom of toxic A. flos-aquae, having a biomass density of 20mg/ml dry weight, would cause death of ducks or calves when 20 ml/kg was consumed whereas a monogastric animal such as a rat would require 80 ml/kg. (Klein)
W77-12848

THE ACCUMULATION, DISTRIBUTION, AND LOSS OF ZINC (65ZN) IN THE GASTROPOD VIVIPARUS ATER (CRISTOFORI AND JAN).
Commission of the European Communities. Ispra (Italy).
For primary bibliographic entry see Field 5B.
W77-12851

THE IMPACT OF A FOREST FIRE ON A WILDERNESS LAKE IN NORTHEASTERN MINNESOTA.
Minnesota Univ., Minneapolis. Limnological Research Center.
J. P. Bradbury, S. J. Tarapchak, J. C. B. Waddington, and R. F. Wright.
Verhandlungen International Vereinigung für theoretische und angewandte Limnologie, Vol. 19, p 875-883, 1975. 7 fig, 1 tab, 14 ref.

Descriptors: *Burning, *Cycling nutrients, *Forest fires, *Nutrients, Lakes, Watershed management, Environmental effects, Ecosystems, Physiochemical studies, Phytoplankton, Hydrology, Limnology, *Minnesota, Paleolimnology, Soil analysis, Nutrient removal, Lake basins.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

By causing only minimal nutrient losses and therefore only slight increases in nutrient supply to lakes, fire was found to play a natural and restrained role in wilderness ecosystems. The conclusions were drawn from paleolimnology, phytoplankton, chemical and hydrological studies done on Meader Lake which had 70% of its watershed burned. (Klein)
W77-12852

POLYCHLORINATED BIPHENYLS IN THE HUDSON RIVER (HUDSON FALLS-FORT EDWARD, NEW YORK STATE),
Environmental Protection Agency, Edison, N. J.
For primary bibliographic entry see Field 5B.
W77-12853

HEART TRANSAMINASE IN THE ROCK CRAB, *CANCER IRROTORATUS*, EXPOSED TO CADMIUM SALTS,
National Marine Fisheries Service, Milford Conn. Middle Atlantic Coastal Fisheries Center.
E. Gould, R. S. Collier, J. J. Karolus, and S. Givens.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 6, p 635-643, 1976. 2 tab, 45 ref.

Descriptors: *Toxicity, *Crabs, Crustaceans, *Metals, *Cadmium, *Animal physiology, *Enzymes, Salts, Chlorides, Proteins, Path of pollutants, Laboratory tests, Analytical techniques, Biochemistry, Nitrates, Enzymes.
Identifiers: Bioaccumulation, Tissue analysis, Rock crab, Cancer irroratus, Heart transaminase.

When rock crab were exposed for 4 days to 1 ppm Cd as the chloride salt, aspartate aminotransferase activity in heart muscle preparations increased significantly over heart AAT in the control crabs. When crabs were exposed to 1 ppm Cd as the nitrate salt in analogous experiments the heart AAT was significantly depressed. Cadmium was clearly indicated as being more toxic as the chloride salt than as the nitrate. (Klein)
W77-12855

EFFECTS OF TWO CHLORINATED PHENOLS ON THE SPONTANEOUS IMPULSE ACTIVITY OF THE ABDOMINAL TONIC MOTOR SYSTEM IN THE CRAYFISH (*ASTACUS FLUVIATILIS* L.),
Helsinki Univ. (Finland). Dept. of Physiological Zoology.
J. Saarikoski, and K. Kaila.
Bulletin of Environmental Contamination and Toxicology, Vol. 17, No. 1, p 40-49, 1977. 3 fig, 1 tab, 17 ref.

Descriptors: *Crustaceans, *Invertebrates, *Crayfish, Animal physiology, *Organic compounds, *Phenols, *Chlorinated hydrocarbon pesticides, Path of pollutants, Analytical techniques, Biochemistry, Toxicity, Electrical properties.
Identifiers: *Astacus fluviatilis, Bioaccumulation, Tissue analysis, Abdominal tonic motor system, PCP, TCP, Pentachlorophenol, Trichlorophenol, Chlorinated phenols.

Both pentachlorophenol (PCP) and 2,3,6-trichlorophenol (TCP) diminished the amplitudes and increased the durations of the extracellular recorded action potentials of the abdominal tonic motor system in the crayfish, which sometimes lead to conduction block in the higher concentrations. PCP was found to be more effective than TCP. In most cases the effects were completely reversible. PCP affected the impulse frequencies of the tonic motor axons in concentrations above 1 ppm, and TCP in concentrations above 10 ppm. (Klein)
W77-12856

METABOLIC RATE AND UTILIZATION OF FOOD RESERVES IN SOME MARINE MUSSELS UNDER REDUCED OXYGEN SATURATION, STOFFWECHSELINTENSITÄT UND RESERVESTOFFABBAU EINIGER MARINER MUSCHELN BEI HERABGESTZTER SAUERSTOFFSATTIGUNG DES MEDIUMS,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
R.-R. Dries, and H. Theede.
Keiler Meeresforschungen, No 3, p 37-48, 1976. 4 fig, 4 tab, 47 ref.

Descriptors: Invertebrates, *Mollusks, *Metabolism, *Oxygen demand, *Water temperature, Clams, *Animal physiology, Biochemistry, Organic compounds, Resistance, Respiration, Environmental effects, Proteins.
Identifiers: *Anoxic conditions, *Glycogen, Western Baltic.

The metabolic rates of the 3 examined species varied in their dependence on temperature, under conditions of oxygen deficiency. Glycogen breakdown was temperature dependent. Protein was also broken down. Accumulation and utilization of reserve compounds were closely linked to the differing resistance of the species to anoxic conditions as well as to recovery respiration after exposure to anaerobic conditions. (Klein)
W77-12857

ACCUMULATION OF 14C-1-NAPHTHALENE BY AN OCEANIC AND AN ESTUARINE COPEPOD DURING LONG-TERM EXPOSURE TO LOW-LEVEL CONCENTRATIONS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5B.
W77-12859

ELEMENTS IN AQUATIC MACROPHYTES, WATER, PLANKTON, AND SEDIMENTS SURVEYED IN THREE NORTH ISLAND LAKES,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 5B.
W77-12860

TOXICITY TESTS ON THE COMBINED EFFECTS OF CHLORINE AND TEMPERATURE ON RAINBOW (*SALMO GAIARDNERI*) AND BROOK (*SALVELINUS FONTINALIS*) TROUT,
Battelle-Northwest, Richland, Wash.
For primary bibliographic entry see Field 5A.
W77-12861

PLUTONIUM IN THE LAURENTIAN GREAT LAKES: FOOD-CHAIN RELATIONSHIPS,
Bureau of Sport Fisheries and Wildlife, Washington, D. C.
For primary bibliographic entry see Field 5B.
W77-12862

THE EFFECT OF THERMAL EFFLUENT ON PHYTOPLANKTON PRODUCTIVITY IN LAKE WABAMUN, ALBERTA,
Alberta Univ., Edmonton.
L. R. Noton.

Verhandlungen International Vereinigung fur theoretische und angewandte Limnologie, Vol. 19, p 542-551, 1975. 6 fig, 17 ref.

Descriptors: *Water temperatures, *Primary productivity, *Effluents, *Phytoplankton, *Heated water, Growth rates, Population, Thermal properties, Inhibition, Water quality, Thermal pollution, Water properties, Bioassay, Primary productivity, *Canada.
Identifiers: *Alberta (Lake Wabamun).

Phytoplankton productivity in warmed waters was greater than in waters of ambient temperatures.

No consistent inhibition of productivity was observed in effluent areas. (Klein)
W77-12864

REVIEW PAPER: THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS AND CORRESPONDING MEASUREMENT PROCEDURES,
British Columbia Research Council, Vancouver.
C. C. Walden.
Water Research, Vol. 10, p 639-664, 1976. 8 fig, 8 tab, 178 ref.

Descriptors: *Reviews, *Bibliographies, *Publications, *Pulp and paper industry, *Effluents, *Toxicity, Pulp wastes, Documentations, Laboratory tests, Measurement, On-site investigations, Environmental effects, Sampling, Data collections, Sources of pollution, Water pollution effects, Bioassays, Trout, Cutthroat trout, Chinook salmon, Rainbow trout, Bioassay, Coho salmon, Toxic compounds.

The effects of pulp and paper mill effluents due to toxicity were examined in a review of the literature. Most of the information came from laboratory studies carried out under controlled conditions, with limited data available concerning the impact of toxicity under conditions in natural ecosystems. (Klein)
W77-12865

USE OF A COLD-WATER REFUGE BY RAINBOW AND BROWN TROUT IN A GEOTHERMALLY HEATED STREAM,
Montana State Univ., Bozeman. Dept. of Biology.
C. M. Kaya, L. R. Kaeding, and D. E. Burkhalter.
The Progressive Fish Culturist, Vol. 39(1): p 37-39, 1977, 11 fig, 12 ref.

Descriptors: *Rainbow trout, *Brown trout, *Thermal water, Fish physiology, *Fish behavior, On-site investigation, Freshwater fish, Water pollution effects, Water temperature, *Thermal stress, Thermal pollution, *Geothermal studies, Cold springs, Cold water fish, Fishing, Seasonal.
Identifiers: *Firehole River, *Yellowstone National Park, *Geothermally heated water, Sentinel Creek.

The Firehole River of Yellowstone National Park receives substantial amounts of geothermally heated water, which raise river temperatures by about 12C. We have recorded summer temperatures as high as 28.8C in the lower section of the river. During the warmest part of the summer, rainbow trout (*Salmo gairdneri*) and brown trout (*S. trutta*) from the river concentrate in Sentinel Creek, the only cold-water tributary along the lower Firehole River. These movements into the creek appear to be related to mean daily temperatures exceeding 24C, or daily maximums exceeding 25C. Aggregations of fish from cooler waters to heated discharge areas have been extensively documented; however, this contrasting situation of fish from a heated body of water concentrating at a cold-water influent area has been reported only once previously and involved a warm-water species. (Katz)
W77-12866

SOME HISTOLOGICAL AND HISTOCHEMICAL OBSERVATIONS ON THE TRANSFER OF TWO METALS (FE3+, CU2+) IN LYMNÆA (GALBA) TRUNCATULA MULLER (DONNEES HISTOLOGIQUES ET HISTOCHEMIQUES SUR LE TRANSFERT DE DEUX METAUX (FE3+, CU2+) CHEZ LYMNÆA (GALBA) TRUNCATULA MULLER), (IN FRENCH),
Limoges Univ. (France). Laboratoire d'Histologie-Embryologie-Cytogenetique.
For primary bibliographic entry see Field 5B.
W77-12867

CELL DIVISION OF GYRODINIUM SP. AND MITOTIC DELAY INDUCED BY CAUSAL SUBSTANCES OF ALGAL TUMOR AND CARCINOGENS.

Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
S. Ishio, J. C. Chen, Y. Kawasaki, and N. Ohba.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 43, No. 5, p 507-516, 1977. 3 fig, 3 tab, 12 ref.

Descriptors: *Dinoflagellates, *Algae, Microorganisms, Plant physiology, *Genetics, *Chromosomes, *Toxins, *Cytological studies, Aquatic life, Biology, Biochemistry, Organic compounds, Path of pollutants, Plant morphology, Metabolism, Bioindicators, Mode of action.
Identifiers: *Carcinogens, Tumors, *Mitosis, Cell division, *Mitotic delay, Bioaccumulation, *Gyrodinium sp., Tissue analysis.

The marine dinoflagellate, *Gyrodinium* sp., displayed cell divisions similar to that of *Gonyaulax catenella*. The cell division periods varied from 4.0 hours at 14.5°C to 2.4 hours at 24°C. Substances causing algal tumors, including benzanthone, 2-chloroanthraquinone and phenanthrene, together with carcinogens 20-methylcholanthrene, 9,10-dimethyl 1,2-benzanthracene and 3,4-benzopyrene brought about mitotic delays in *Gyrodinium* sp. The examination of mitotic delay in *Gyrodinium* sp. was suggested as a method for detection of carcinogens discharged into coastal waters. (Klein) W77-12868

A PRELIMINARY STUDY OF THE TOXIC EFFECTS OF IRRADIATED VS. NON-IRRADIATED WATER SOLUBLE FRACTIONS OF NO. 2 FUEL OIL.

Academy of Natural Sciences of Philadelphia, Pa. Div. of Limnology and Ecology.
A. Scheier, and D. Goming.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 5, p 595-603, 1976. 3 tab, 8 ref.

Descriptors: *Toxicity, *Oil, *Fuels, *Ultraviolet radiation, Oil pollution, Oil wastes, Oily water, Fossil fuels, Laboratory tests, Shrimp, Channel catfish, Sunfishes, Environmental effects, Radiation, Chemistry, Bioassay.
Identifiers: No. 2 fuel oil, *Water soluble fraction, Grass shrimp, Sheephead minnow, Mummichog, Bluegill sunfish.

The toxic effects of the water soluble fraction of No. 2 fuel oil on a number of test organisms was presented. Exposure to ultra violet light was found to increase toxicity of the pollutant. The test species investigated were the grass shrimp, sheephead minnow, mummichog, channel catfish, and the bluegill sunfish. (Klein) W77-12869

MIREX AND MARINE UNICELLULAR ALGAE: ACCUMULATION, POPULATION GROWTH AND OXYGEN EVOLUTION.

Environmental Research Lab., Gulf Breeze, Fla.
T. A. Hollister, G. E. Walsh, and J. Forester.
Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 6, p 753-759, 1975. 2 tab, 2 fig, 7 ref.

Descriptors: *Algae, *Productivity, *Adsorption, *Growth rates, *Chlorinated hydrocarbon pesticides, Path of pollutants, Oxygen, Organic compounds, Populations, Toxicity, Chlorophyta, Rhodophyta, Chlamydomonas.
Identifiers: *Mirex, Bacillariophytes, Bioaccumulation.

Accumulation of mirex by the algae was evident. Algae tested were chlorophytes, bacillariophytes, and rhodophytes. Under laboratory conditions, mirex had no significant effect on either population growth or oxygen evolution of the selected species of marine algae. (Klein)

W77-12870

MINIMAL DISSOLVED OXYGEN REQUIREMENTS OF AQUATIC LIFE WITH EMPHASIS ON CANADIAN SPECIES: A REVIEW.

Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
J. C. Davis.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 12, p 2295-2331, 1975. 19 fig, 10 tab, 112 ref.

Descriptors: *Reviews, *Aquatic life, *Speciation, *Canada, *Dissolved oxygen, *Oxygen requirements, Data collections, Documentation, *Bibliographies, Publications, Respiration, Oxygen, Ecosystems, Lethal limit, Toxicity.

This article reviewed the sensitivity, responses, response thresholds, and minimum oxygen requirements of marine and freshwater organisms with strong emphasis on Canadian species. The analysis attempted to define low dissolved oxygen thresholds which produce some physiological, behavioral, or other response in different species. Oxygen availability was discussed with reference to seasonal, geographical, or spatial variation in dissolved oxygen. Factors affecting availability of dissolved oxygen included atmospheric exchange, mixing of water masses, upwelling, respiration, photosynthesis, ice cover, and physical factors such as temperature and salinity. Dissolved oxygen terminology was summarized and tables were included for both fresh and saltwater O₂ solubility at different temperatures. Incipient O₂ response thresholds were used in a statistical analysis to develop oxygen criteria for safeguarding various groups of freshwater and marine fish. Oxygen tolerances and responses of aquatic invertebrates to low oxygen was reviewed for freshwater and marine species according to habitat. (Klein) W77-12871

CHARACTERISTICS OF SUSPENSIONS OF KUWAIT OIL AND COREXIT 7664 AND THEIR SHORT- AND LONG-TERM EFFECTS ON TISBE BULBISSETOSA (COPEPODA: HARPACTICOIDA).

Istituto di Biologia del Mare, Venice (Italy).
For primary bibliographic entry see Field 5B.
W77-12872

EFFECTS OF TIDAL FLUCTUATIONS OF SALINITY ON PERICARDIAL FLUID COMPOSITION OF THE AMERICAN OYSTER CRASSOSTREA VIRGINICA.

Louisiana State Univ., Baton Rouge. Dept. of Zoology and Physiology.
S. C. Hand, and W. B. Stickle.
Marine Biology, Vol. 42, p 259-271, 1977. 7 fig, 4 tab, 23 ref.

Descriptors: *Salinity, *Ions, *Oysters, Animal physiology, *Tidal waters, *Osmotic pressure, Water properties, Metals, Animal behavior, Invertebrates, Osmosis, Organic compounds, Movement, Environmental effects, Mollusks.
Identifiers: *Pericardial fluid, *American oyster.

Oysters were subjected to simulated tidal fluctuations of salinity, and the subsequent effects on osmotic and ionic composition of the pericardial fluid, body water, and valve movements were investigated. Pericardial fluid osmolality, concentrations of Cl⁻, Na⁺, Mg⁺⁺, K⁺, Ca⁺⁺ and ninhydrin-positive substances (NPS) were analyzed. In the 2-week experiment, pericardial fluid osmolality tracked ambient seawater closely through Day 5, but became more intermediate between high and low seawater values as the experiment progressed. Similar patterns during fluctuations of salinity were observed for Na⁺, Cl⁻, Mg⁺⁺, and Ca⁺⁺. Pericardial fluid K⁺ levels did not track ambient seawater as closely as did other ions. The ionic composition of dilution water had

little effect on the osmotic or ionic response to the oyster's pericardial fluid. NPS values gradually decreased. Percent body water also varied inversely with ambient salinity. Solute movement accounted for most of the change in pericardial fluid osmolality. (Klein) W77-12873

STUDIES ON THE TOXICITY OF CADMIUM TO THE THREE-SPINED STICKLEBACK GASTEROSTEUS ACULEATUS L.,

University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
D. Pascoe, and D. C. Matthey.
Journal of Fish Biology, Vol. 11, p 207-215, 1977. 2 fig, 4 tab, 18 ref.

Descriptors: *Toxicity, *Metals, *Mortality, *Cadmium, *Sticklebacks, Path of pollutants, Mode of action, Lethal limit, Fish parasites, Metabolism, Analytical techniques, Adsorption, Fish physiology.
Identifiers: Bioaccumulation, Tissue analysis, *Gasterosteus aculeatus*, *Three-spined stickleback.

Cadmium was found to be lethal to sticklebacks at all concentrations from 100.0 to 0.001 mg Cd, in water of 103-111 mg l⁻¹ hardness as CaCO₃. The pattern of mortality as shown by the time-concentration curve suggested that toxicity was not due to a single mechanism but changes with concentration. Fish were found to accumulate Cd, the whole body levels increasing from 0.90 microg/g fresh weight at 0.001 mg Cd l⁻¹ exposure concentration to 51.0 microg/g at 100 mg Cd l⁻¹. The concentration factor was shown to decrease with increasing exposure concentration from 0.51 at 100 mg Cd l⁻¹ to 511 at 0.001 mg Cd l⁻¹. The plerocercoid parasite *Schistocephalus solidus* in the host's perivisceral cavity contained less Cd than the tissues of its host. (Klein) W77-12874

MICROBIOLOGICAL STUDIES OF TOKYO BAY.

Tokyo Univ. (Japan). Ocean Research Inst.
U. Simidu, E. Kaneko, and N. Taga.
Microbial Ecology, Vol. 3, p 173-191, 1977. 5 fig, 5 tab, 17 ref.

Descriptors: *Bacteria, *Primary productivity, *Eutrophication, *Phytoplankton, Bays, Water quality, Biomass, Aquatic microorganisms, Growth rates, Nutrients, Microbiology, Marine bacteria, Aquatic microbiology.
Identifiers: *Tokyo Bay, *Vibrio sp.

The generic composition of the heterotrophic bacterial population of Tokyo Bay, a highly polluted and eutrophic area, was compared with that of the adjacent, less polluted regions of Sagami Bay and Suruga Bay. Members of Vibrionaceae predominated in the bacterial flora of seawater and zooplankton samples from Sagami Bay, Suruga Bay, and the mouth of Tokyo Bay. *Vibrio* sp. formed only a small portion of the bacterial population of the water and sediment samples from the inner Tokyo Bay. There the Gram-negative, non-motile, nonpigmented bacteria, tentatively identified as *Acinetobacter*, were predominant. The results of experiments in which seawater samples from Tokyo Bay were incubated under various experimental conditions indicated that two significant factors apparently control the growth of *Vibrio* sp. in seawater: (1) a direct antagonism between *Vibrio* sp. and phytoplankton undergoing rapid growth, and (2) a limiting organic nutrient for *Vibrio* sp. (Klein) W77-12875

POLYCHAETE SPECIES DIVERSITY AND PHYSICAL ENVIRONMENT OF SEDIMENT IN USU BAY, (IN JAPANESE).

Hokkaido Univ., Hakodate (Japan). Lab. of Marine Culture.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

S. Nakao.

Bulletin of the Faculty of Fisheries. Hokkaido University, Vol. 28, No. 1, p 20-28, 1977. 8 fig, 3 tab, 23 ref.

Descriptors: *Sediments, *Speciation, *Worms, Organic compounds, Sedimentology, Sedimentation, Bays, Sediment distribution, Aquatic life, Silts, Clay, Aquatic soils, *Invertebrates, Methodology, Carbon, Mollusks, Clams, Benthos. Identifiers: *Species diversity, *Usu Bay, *Polychaetes, Hokkaido, Japan, Diversity index, Sediment analysis, Organic carbon.

The objective of this study was to ascertain the factors potentially affecting the polychaete species diversity. The diversity indices of several species were applied to the data collected in Usu Bay, Hokkaido. Sediment analyses, grain composition and organic carbon content were used to explain the causes of diversity gradients. These diversity indices were not found to be clearly correlated to the sediment parameters of the median diameter, silt-clay fraction and organic carbon. But sorting was apparently the important cause by which to explain diversity gradients. The stability-time hypothesis was supported in this study. (Klein) W77-12876

EFFECTS OF WATER POLLUTED BY OIL ON AQUATIC ANIMALS IV. QUANTITATIVE DETERMINATION OF C14-C24 N-PARAFFINS IN MARINE SEDIMENTS AND SCALLOPS (PECTEN YESSOENSIS). Hokkaido Univ., Hokkaido (Japan). Faculty of Fisheries.

T. Motohiro, and Z. Iseya. Bulletin of the Faculty of Fisheries. Hokkaido University, Vol. 27, p 191-196, 1976. 4 fig, 7 ref.

Descriptors: *Organic compounds, *Path of pollutants, *Sediments, Gas chromatography, Invertebrates, Environmental effects, Aquatic life, Water pollution effects, Water quality, Analytical techniques, Sampling, *Oil, *Oil pollution, Commercial shellfish, Path of pollutants. Identifiers: *Scallops, Pecten yessoensis, *Paraffins, Bioaccumulation, Tissue analysis, Japan.

A study was made to determine whether the gas chromatography for quantitative detection was applicable to n-paraffins, and to determine whether the C14-C24 n-paraffin concentrations could be detected quantitatively in marine sediments. A comparison of the concentrations of n-paraffins composition from C14 to C24 in marine sediments and in scallops was made also. N-Paraffins from C14 and C24 were contained in the marine sediments which were collected from the fishing ground of scallops and a similar chromatogram pattern was also obtained from the sample of scallops. (Klein) W77-12877

NUTRIENTS IN ALBERMARLE SOUND, NORTH CAROLINA. North Carolina State Univ. at Raleigh. Dept. of Zoology.

For primary bibliographic entry see Field 5B. W77-12912

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL TECHNICAL SUMMARY REPORT.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs. For primary bibliographic entry see Field 6G. W77-12963

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-

DECEMBER 1976. VOLUME 1: RECEPTORS (BIOTA); MARINE MAMMALS; MARINE BIRDS; MICROBIOLOGY.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

For primary bibliographic entry see Field 6G. W77-12964

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 2: RECEPTORS (BIOTA); FISH; PLANKTON; BENTHOS; LITTORAL.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

For primary bibliographic entry see Field 6G. W77-12965

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 4: HAZARDS; DATA MANAGEMENT.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

For primary bibliographic entry see Field 6G. W77-12966

POLYCHLORINATED BIPHENYLS IN NATURAL WATERS AND THEIR BIOLOGICAL DANGER. (IN RUSSIAN). Akademiya Nauk URSR, Kiev. Inst. of Colloidal Chemistry and Water.

For primary bibliographic entry see Field 5A. W77-12967

THE INFLUENCE OF AERATION IN THE DETERMINATION OF TOXICITY FOR FISH. (IN GERMAN).

Bundesgesundheitsamt, Berlin (West Germany). Institut fuer Wasser-, Boden-, und Luftthygiene. F. Herzel, G. Schmidt, and P. Sobhani. Z Angew Zool 63(2), p 137-144, 1976.

Descriptors: *Toxicity, *Aeration, Fish, DDT, Aldrin, Dieldrin, Lindane, Pesticide residues, Solubility, Water pollution effects. Identifiers: Carbaryl, Cresol, Dichlobenil, Dinocap, Monolinuron.

For determination of the toxicity for fish of a particular substance, knowledge of the behavior of the latter in water is important. Decisive factors are the true solubility in water and the rate of natural decrease in the test aquarium. For 9 pesticides (carbaryl, lindane, aldrin, DDT, dieldrin, monolinuron, dichlobenil, dinocap, DNOC (dinitrocresol)) (active substances), the tendency of volatilization was established in aerated and non-aerated aquaria of 12 l capacity. Copyright 1977, Biological Abstracts, Inc. W77-12968

THE DECOMPOSITION RATE OF ORGANIC MATTER OF STEPHANODISCUS HANTZSCHII GRUN. FROM THE CHANNEL OF THE NORTHERN DONETS BASIN. (IN RUSSIAN). Central Control Research Project, Donetsk (USSR). Research Water Lab.

For primary bibliographic entry see Field 5B. W77-12971

EFFECTS OF CONTINUOUS ENRICHMENT WITH NITRATES ON POPULATIONS OF DIATOMS ISOLATED WITH THE AID OF ENCLOSURES IN AN OLIGOTROPHIC POND. (IN FRENCH). Rennes Univ. (France). Hydrobiological Lab. R. Lecohu.

Int Rev Gesamten Hydrobiol 61(6), p 789-798, 1976.

Descriptors: *Nitrates, Nutrients, Eutrophication, *Oligotrophy, *Diatoms, Ponds, Water pollution effects. Identifiers: Achnanthes-minutissima, Fragilaria-construens, Gomphonema-parvulum, Isolated.

The influence of nitrates (NH4NO3, KNO3 and Ca(NO3)2) on diatom populations was studied. These populations were isolated by enclosures with transparent walls, without bottom or lid, placed in an oligotrophic pond. The addition of NH4NO3 generally resulted in a decrease in the number of diatoms and the disappearance of some species. The addition of KNO3 and Ca(NO3)2 was followed, during some periods, by a very important increase of Achnanthes minutissima, Fragilaria construens and Gomphonema parvulum. Copyright 1977, Biological Abstracts, Inc. W77-12972

SEASONAL DYNAMICS OF HEMATOLOGICAL INDICES IN SOME BLACK SEA FISH AND CHANGES IN THESE INDICES DURING EXPERIMENTAL POISONING BY PETROLEUM PRODUCTS. (IN RUSSIAN). All-Union Research Inst. of Marine Fisheries and Oceanography, Batumi (USSR).

A. M. Kotov. Gidrobiol Zh 12(4), p 63-68, 1976.

Descriptors: *Seasonal, *Metabolism, Oil pollution, *Oil wastes, Water pollution effects, Fish. Identifiers: *Black Sea, *Diplodus-annularis, *Hematological indices, Leukocyte, *Solea-las-caris-nasuta, *Spicara-smaris.

Seasonal periodicity in the life cycles of Spicara smaris, Diplodus annularis and Solea lascaris nasuta, consisting of an increase in the intensity of metabolic processes in the spring and summer and a decrease in the winter, were reflected in the blood indices. Quantitative differences in blood indices among the 3 spp. were associated with differences in their habitats and activity levels. Petroleum in concentrations of 0.05-22.0 mg/l induced leukocytosis, most sharply expressed in D. annularis and S. lascaris nasuta. Disturbances in the leukocytic formation were manifested in the form of eosinophilia, monocytopenia and neutrophilic leukocytosis in these 2 spp., and in the form of neutrophilia and lymphocytosis in S. smaris. Qualitative changes in the red blood indices were also observed in the fish. Blood indices may be used as criteria in evaluating the toxicological action of dissolved petroleum products of fish. Copyright 1977, Biological Abstracts, Inc. W77-12973

LIPOLYTIC ENTEROBACTERIA OF THE ODESSA BAY LITTORAL ZONE. (IN UKRAINIAN).

Institute of Biology of the Southern Seas, Odessa (USSR).

N. H. Teplins'ka. Mikrobiol Zh (Kiev) 38(4), p 495-498, 1976.

Descriptors: *Enteric bacteria, Bays, *Littoral, Proteins, Salmonella, Water pollution effects. Identifiers: Citrobacter, Enterobacter, Hafnia, Lipase, Pectobacterium, *USSR(Odessa Bay).

Above 50% of enterobacteria occurring in littoral waters of the Odessa Bay (USSR) are capable of producing exolipase. The amount of lipolytic intestinal bacteria is rather high in the region under study (up to 250,000 cells/ml) and varies mainly depending on the season. A tendency toward decreased amounts of lipolytic bacteria when moving away from the shore at different distances was observed. In most cases lipids of the autochthonous and allochthonous origin in littoral waters of the Odessa bay are hydrolyzed actively by enterobacteria of the genera Proteus, Pectobac-

terium, Enterobacterium, Salmonella, Hafnia, Citrobacter. Copyright 1977, Biological Abstracts, Inc.
W77-12974

HYDROBIOLOGICAL RESEARCH RELATED TO LARGE SCALE EXPERIMENTAL POLLUTION STUDIES IN THE RANCE ESTUARY: PRIMARY PRODUCTION IN RELATION TO CERTAIN PHYSICO-CHEMICAL PARAMETERS, (IN FRENCH), Museum National d'Histoire Naturelle, Paris (France). Laboratoire de Physiologie Generale et Comparee.

J. C. Lacaze, L. Zavie, and V. D. N. Olivier.
Bull Mus Natl Hist Nat Ecol Gen 32, p 71-105, 1976.

Descriptors: *Primary productivity, *Chlorophyll, Phosphorus, Physicochemical properties, Nitrogen, Estuaries, Carbon.
Identifiers: *France(Rance estuary).

The Maritime Rance (France) constitutes a marine reservoir which lends itself readily to full-scale in situ experimental studies of water pollution by petroleum products. These research projects require basic hydrobiological investigations at the experimental zone, prior to and concomitant with the implementation of deliberate pollution procedures. The dam of the Rance tidal power station exerts an important ecological role on this area, providing it with highly original features: substantial homogenization of waters, decreased amplitude of tidal movements, increased immersion time. The experimental zone selected for ecological and logistic reasons is productive, without exhibiting excessive eutrophication. Its primary production, 2-4 times greater than that observed in the vicinity of Roscoff, varies during the year from 2(Feb.) to 20 mgC/m³ per h(June, Sept.). Other parameters provide complementary indications. One of these is the fluctuation in nutrient salt concentrations: N(nitrites and nitrates) from 0(May) to 10 g-at/1(Feb.), phosphates from 0.04(May) to 0.39 g-at/1(Feb.); N/P ratios from 15 to 100. Chlorophyll a concentrations range from 0.50(Oct. 1972) to 3 mg/1(June 1972). Copyright 1977, Biological Abstracts, Inc.
W77-12975

ZOOPLANKTON OF THE DNIESTER ESTUARY AND ADJACENT SEASIDE UNDER ANTHROPOGENIC INFLUENCES, (IN RUSSIAN), Institute of Biology of the Southern Seas, Odessa (USSR).
For primary bibliographic entry see Field 5B.
W77-12977

STUDIES OF THE CAUSES OF FISH MORTALITY IN LAKE BALATON IN 1975, (IN HUNGARIAN), Mem Novenyvedelmi Kozpont (Hungary). Vizelettani Lab.
For primary bibliographic entry see Field 5B.
W77-12981

STUDY OF MARINE FAUNA FROM ROCKY SUBSTRATES IN THE ZONE OF SEWAGE OUTFALL OF THE CITY OF MARSEILLE (FRANCE), (IN FRENCH), Ecole Agents Technique Peches, Dakar (Senegal). D. Leung Tack Kit.
Tethys 7(2/3), p 191-212, 1975 (1976).

Descriptors: *Marine animals, *Sewage outfalls, Seasonal, Bioindicators, Algae, Water pollution, Sewers.
Identifiers: *France(Marseille).

Seasonal changes of the benthic fauna in the vicinity of the sewage outfall area and the respec-

tive changes of fauna due to the distance from the outfall were studied. The settlement at the sewer exit is composed of species which are common in clean waters, but tolerant to pollution. The indicator species of pollution are present in limited numbers. Outside the sewer area, the rocky substratum is wholly covered with calcareous algae, the presence of which induces an environment which favors the species of holes and crevices and hard substrates. Copyright 1977, Biological Abstracts, Inc.
W77-12982

BOTTOM MICROFLORA AND BENTHOS OF LAKE DAL'NEYE (KAMCHATKA), (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
E. B. Pavel'Eva, M. I. Vasil'Eva, and Yu. I. Sorokin.
Gidrobiol Zh 12(5), p 59-63, 1976.

Descriptors: *Benthos, *Benthic flora, Lakes, *Biomass, *Bacteria, Carbon, Nitrogen, Organic matter, Primary productivity, Protozoa, Invertebrates, Salinity.
Identifiers: *USSR(Lake Dal'neye), Organic carbon.

In order to evaluate the role of the bottom population in the energy balance of a lake, the population, biomass and bacterial production, biomass of micro- and macrobenthos on bottoms and their organic C and general N composition in Lake Dal'neye (Russian SFSR, USSR) were determined. The content of organic substances and the salinity of the bottom can be inversely correlated. Tentative production of macrobenthos for 1 yr was 25 g/m² and 4.2 g/m² for microbenthos. The bottom association consumed 15% of the energy resources created by primary production. Fauna observed (bacteria, protozoa, fish, invertebrates) are mentioned according to higher categories. Copyright 1977, Biological Abstracts, Inc.
W77-12988

DEHYDROGENASE ACTIVITY IN THE BOTTOM SEDIMENTS OF THREE LAKES, Nicolas Copernicus Univ. of Torun (Poland). Inst. of Biology.
W. Donderski, and S. Marek.
Acta Microbiol Pol 26(1), p 95-103, 1977.

Descriptors: *Bottom sediments, Lakes, *Lake sediments, *Bacteria, Seasonal, *Eutrophication, Temperature, Hydrogen ion concentration, Water pollution effects.
Identifiers: *Dehydrogenase activity, *Poland(IIawa Lakeland).

Dehydrogenase activity was studied in the sediments of 3 lakes of the IIawa Lakeland (Jeziorak, Maly Jeziorak and Jasne) (Poland) with reference to the type of lake, the season of the year, the situation of the sediments, pH and temperature. The highest activity was found in the sediments of the eutrophic lake Jeziorak sampled during the summer from places in the vicinity of a village. The lowest activity was exhibited by sediments sampled in the autumn in the lakes Jasne and Maly Jeziorak. No correlation was found between dehydrogenase activity and the number of bacteria in the sediments. The highest dehydrogenase activity was found at 20 degrees C and pH 7.0 and 8.0-8.25. Copyright 1977, Biological Abstracts, Inc.
W77-12989

RELATIONSHIPS BETWEEN PHOTOSYNTHETIC PRODUCTION AND LIGHT PENETRATION IN WATERS OF LAKE BERRE, (IN FRENCH), Centre Universitaire de Luminy, Marseille (France). Lab. of Prod. Pelagique.
For primary bibliographic entry see Field 2H.
W77-12990

5D. Waste Treatment Processes

A PREDICTIVE MODEL FOR THE REMOVAL OF POLLUTANTS IN PACKED BEDS USEFUL FOR OPTIMAL PROCESS DESIGN, Maine Univ. at Orono. Dept. of Civil Engineering. M. M. Ghosh.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 626. Price codes: A03 in paper copy, A01 in microfiche. Maine Land and Water Resources Institute, Orono, Completion Report, June 1977. 29 p, 11 fig, 4 tab, 5 ref. OWRT A-032-ME(1).

Descriptors: *Clogging, Optimization, Polymers, Sewage effluents, Pollutants, Suspension, *Waste water treatment, Zeta potential, Model studies, *Filters, *Filtration, Phosphates.
Identifiers: *Calcium phosphate, Direct filtration, *Kaolin, Predictive models.

A conceptual model developed in an earlier study (See W-77-02086) for the initial collection of particulate matter in homogeneous deep filters was successfully tested for three natural suspensions, namely kaolin, calcium phosphate, and the effluent from a secondary wastewater treatment plant, using deep beds of sand. The effects of polymer dosage, flow-through velocity, and sand size were investigated. An attempt was made to develop a predictive model for the clogging dynamics of deep bed filters. A conceptual model has been developed for the optimum operation of deep bed filters. However, attempts to develop a general, mechanistic model for clogging filters were thwarted because of the highly varying nature of particulate suspensions that are encountered in nature. A model is proposed based on certain experimental observations and can be used to optimize filtration of a well-defined suspension.
W77-12251

MAGNETIC SEPARATION OF SOLUBLE ORGANIC POLLUTANTS FROM WATER, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering. J. A. Petruska, and J. V. Perumpral.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 667. Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin 108, September 1977. 68 p, 26 fig, 11 tab, 36 ref. OWRT A-065-VA(2).

Descriptors: Food processing industry, Activated carbon, *Waste water treatment, Nutrient removal, Water purification, Adsorption, *Organic wastes, *Separation techniques, Industrial wastes.
Identifiers: *High gradient magnetic separation.

The potential use was studied of High Gradient Magnetic Separation (HGMS) for removing soluble organics in water and for treating composite wastewater from a food processing unit. The initial investigation was of soluble organic removal by a combined use of activated carbon adsorption and HGMS. Tests with known concentrations of soluble starch revealed that, although adsorption of the organic could be accomplished, the removal of activated carbon in the magnetic separator was inefficient. Only approximately 70 percent of the applied carbon could be removed from the water slurry by HGMS. Magnetic separation then was used to treat composite wastewater samples collected from a food processing unit. Treatment effectiveness was evaluated by monitoring certain pollution-related parameters such as color plus turbidity, chemical oxygen demand, total phosphorus, and solids. In most cases, reductions in these parameters after magnetic treatment were noted. However, higher reduction rates would be necessary before the HGMS method becomes a viable alternative treatment method for food processing wastewater.
W77-12255

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

RESOURCE INFORMATION APPLIED TO WATER SOURCES AND DISCHARGES AT EXISTING AND POTENTIAL POWER PLANT SITES IN ARIZONA AND THE SOUTHWEST, Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 3E.
W77-12263

CALIFORNIA'S WATER RECLAMATION AND DESALINIZATION PROJECTS, California State Dept. of Water Resources, Sacramento.
M. Blanton.
Water and Sewage Works, p 60-62, May 1977. 5 fig.

Descriptors: *California, *Water reuse, *Desalination, *Projects, *Project planning, Desalination plants, Planning, Water resources development, Project purposes, Research and development, State governments, Water policy, Waste water treatment, Reverse osmosis, Design, Cooling water, Cost analysis.
Identifiers: California Water Plan.

An overview is presented of reclamation and desalination projects in California already underway or in the planning stage, many of them initiated by the California Department of Water Resources (DWR). The DWR is responsible for the ongoing assessment of the California Water Plan, construction and operation of the State Water Project, public safety (through flood control and dam safety activities) and water resources investigations. The department's Water Management Policy calls for development of water resources through reclamation and other means. Various projects undertaken since 1970 are outlined. The Wastewater Treatment Evaluation Facility near Firebaugh, California, has been the site of tests on reverse osmosis as a method for desalinating agricultural wastewater; design and cost estimating of commercial-size units have also been done. Under consideration by the DWR is the use of agricultural wastewater, with its high concentration of minerals, as a source of cooling water for inland steam electric power plants; doing this without pretreatment has been the major problem. A plan for water reclamation is outlined, and pilot plants for using wastewater on soil, groundwater and crops are described. (Jahns-Arizona)
W77-12295

PROCESS FOR PURIFYING INDUSTRIAL EFFLUENTS. CIBA-GEIGY Ltd., Basel (Switzerland).
British Patent No. 1,466,473. March 9, 1977. 14 p, 31 claims, 5 tab.

Descriptors: *Patents, *Pulp wastes, *Waste water treatment, *Adsorption, Wastes, Industrial wastes, Pulp and paper industry, Water pollution treatment, Waste treatment, Effluents.
Identifiers: Charcoal, Sulfite pulp, Dicyandiamide, Urea, Formaldehyde, Condensation product.

A process for purifying industrial effluents (e.g., waste pulping liquor from the paper industry) comprises contacting the effluent with an adsorbent containing a carrier pretreated with a basic precipitant, and activated charcoal. For example, the carrier can be bleached pine sulfite pulp treated with a dicyandiamide/urea/HCHO condensation product. (Lynch-IPC)
W77-12335

PCBS CAN BE MADE VIRTUALLY HARMLESS. Chemistry in Canada, Vol. 28, p 15-16, June, 1976.

Descriptors: *Pulp wastes, *Waste water treatment, *Polychlorinated biphenyls, *Biodegradation, *Ultrasonics, Wastes, Industrial

wastes, Water pollution sources, Water pollution treatment, Waste treatment, Bacteria, Dispersion.

A new process for rendering PCB's virtually harmless is based on dispersion of the PCB's in pulp mill effluent via ultrasonic vibration followed by introduction of a newly developed bacterial strain. Even the most stubborn members of the PCB family are reduced in one week from concentrations of 300,000 parts per billion to 19 ppb. While the new technique appears to have promising possibilities for waste treatment, it still needs to be adapted for practical application. (Speckhard-IPC)
W77-12336

SYNTHESIS AND STUDY OF ION-EXCHANGE CELLULOSES. THEIR USE IN THE PURIFICATION OF WASTE WATERS FROM THE TEXTILE INDUSTRY. I. SYNTHESIS OF A CELLULOSE GRAFTED WITH POLYACRYLIC ACID CHAINS AND OF A CELLULOSE INCORPORATING QUATERNARY AMMONIUM (IN FRENCH), Centre de Recherche des Industries Textiles de Rouen (France).
A. Gangneux, D. Wattiez, and E. Marechal.
European Polymer Journal, Vol. 12, No. 8, p 535-541, 1976. 3 fig, 22 ref, 3 tab.

Descriptors: *Textiles, *Waste water treatment, *Ion exchange, *Cellulose, Cation exchange, Anion exchange, Dyes, Water pollution treatment, Waste treatment, Wastes, Industrial wastes, Water pollution sources, Effluents.
Identifiers: Epichlorohydrin, Triethylamine, Acrylic acid.

Optimum conditions were determined for the industrial-scale preparation of a cellulosic cation exchanger (cellulose grafted with polyacrylic acid using ceric ion as catalyst) and a cellulosic anion exchanger (triethylammoniumpropoxycellulose chloride), especially designed for use in purifying textile industry effluents (removal of dyes, etc.). The anion exchanger was prepared in one step from cellulose, epichlorohydrin, and triethylamine. (Speckhard-IPC)
W77-12337

STUDY OF THE INFLUENCE OF ELECTROCOAGULATION CONDITIONS ON THE EFFICIENCY OF PULP AND PAPER MILL EFFLUENT PURIFICATION (IZUCHENIE VLIYANIYA USLOVII ELEKTROKOAGULYATSII NA EFEKTIVNOST' OCHISTKI STOCHNYKH VOD TSELYULOZNO-BUMAZHNOI PROMYSHLENNOSTI), Irkutskii Inst. Organicheskoi Khimii (USSR).
E. N. Serdobol'skii, M. I. Anisimova, and V. A. Babkin.
Khimiya Drevesiny (Riga), No. 6, p 76-80, November/December, 1976. 3 fig, 7 ref, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Electrochemistry, *Coagulation, Wastes, Waste treatment, Water pollution treatment, Water pollution sources, Foreign countries, Electric currents, Hydrogen ion concentration, Electrodes, Aluminum, Iron, Titanium, Chemical oxygen demand, Color, Phenols, Pulp and paper industry, Water quality control, Effluents, Bleaching wastes.
Identifiers: USSR.

The effects of current density, pH, and electrode material (Fe, Al, and Ti) on the electrochemical coagulation of effluents from the Baikal (USSR) pulp mill were studied. Effluents from the first-stage chlorination of cord-grade pulp were satisfactorily purified with Fe and Al as dissolving anodes, although the Al electrode was useful over a wider pH range, required less power, and was more uniform over a wide range of current densities. The degree of effluent purification was 79.0-88.0% for COD, 94.0-96.0% for decoloration, and 91.0-93.0% for steam-volatile phenols. Effluents

from the pulpwood-process plant and from the condensate evaporation station were tested with only Fe and Al anodes. The Fe anode functioned best at current densities near 0.07 amp/sq cm, while satisfactory results with the Al anode were obtained using a current density of 0.02 amp/sq cm. The high sedimentation rates and high adsorption capacities of the metal hydroxides produced by dissolution of the anode plus the compactness of the installation make it possible to significantly reduce the load on the purification facilities of the pulp mill and to increase the quality of the water being discharged. (Chem-IPC)
W77-12338

CALCULATIONS OF SCRAPING MECHANISMS FOR THE REMOVAL OF PRECIPITATE FROM SEDIMENTATION TANKS (RASHCHET SKREBKOVYKH MEKHANIZMOV DLYA UDALENIYA OSADKA IZ OTSTOYNIKOV), Politeknicheskii Institut, Leningrad (USSR).
G. A. Petrov.
Mezhvuzovskii Sbornik Nauchnykh Trudov, Khimicheskaya i Mekhanicheskaya Pererabotka Drevesiny i Drevesnykh Otkhodov, No. 2, p 105-108, 1976. 2 fig, 1 tab.

Descriptors: *Sludge treatment, Electric power demand, *Operation and maintenance, Energy, *Waste water treatment, Waste treatment, Separation techniques, Equipment, Treatment facilities, *Settling basins.
Identifiers: *Scrapers, *Settling tanks.

The types of sedimentation equipment in which scraping mechanisms are used for collecting and removal of precipitates are discussed, and results are given of laboratory experiments in which determinations were made of the collecting capacity of scrapers and of the scraping forces in the removal of precipitates from primary sedimentation tanks and savealls. The experimental graphs obtained can be used to calculate the power necessary for the scraping operation and the consumption of electric energy, and to select the proper height of the scrapers and the scraping angle. (Stapinski-IPC)
W77-12339

INVESTIGATION OF COMBINED WASHING OF THE SAND FILTER IN THE PURIFICATION OF KRAFT MILL EFFLUENTS (ISLEDOVANIYE KOMBINIROVANNOI PROMYVKI PESCHANOGO FIL'TRA PRI OCHISTKE STOKOV SUL'FAT-TSELYULOZNOGO PROIZVODSTVA), Leningradskaya Lesotekhnicheskaya Akademiya (USSR).
V. M. Voronin, B. V. Ermolov, and G. A. Romanov.
Mezhvuzovskii Sbornik Nauchnykh Trudov, Khimicheskaya i Mekhanicheskaya Pererabotka Drevesiny i Drevesnykh Otkhodov, No. 2, p 87-90, 1976. 2 fig, 1 tab.

Descriptors: *Pulp wastes, *Filtration, *Waste water treatment, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Sands, Foreign countries, Pulp and paper industry, Suspended solids, *Filters, Effluents.
Identifiers: USSR, *Sand filters.

Sand filters are used at the Baikal (USSR) kraft pulp mill for mechanical purification of effluents that have been subjected to chemical purification. During the passage through the filter, 90-95% of the suspended solids are retained by the filter and form a film on the filter surface. The presently used method of washing the filter through the drainage system is inefficient in removing this film. Additional washing equipment has been designed, consisting of a system of tubes, a pump, and spray heads distributed over the surface of the sand. Results are given of tests conducted on com-

bined washing (from above and through the drainage pipes) of the filter, which demonstrate its effectiveness in breaking down and removing the film. The combined washing system prolongs the service time of the filter charge from 3-4 months to 2 years. (Stapinski-IPC)
W77-12340

REVERSE OSMOSIS AND SYNTHETIC MEMBRANES: THEORY, TECHNOLOGY, ENGINEERING,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
S. Sourirajan.
National Research Council of Canada (Ottawa, Ontario. K1A 0R6), Publication No. 15627, 598 p, 1977.

Descriptors: *Reverse osmosis, *Technology, Engineering, Theoretical analysis, Membranes, *Membrane processes, *Separation techniques, *Pulp wastes, *Waste water treatment, Water pollution treatment, Pulp and paper industry, Waste treatment, Industrial wastes, Design.

Reverse osmosis science, comprised of the physicochemical basis for reverse osmosis separations, the materials science of reverse osmosis membranes, and the engineering science of reverse osmosis transport, is a new and developing science and should be of significance to many other areas of science and engineering involving fluid-solid interfaces and/or fluid permeation through microporous media. A review of recent developments in some of the major aspects of the science, technology, and engineering of reverse osmosis is presented in this collection of 28 contributions by 44 authors, all of whom are actively working with reverse osmosis. One chapter is devoted to applications of reverse osmosis in paper industry, and several chapters deal with other industrial waste treatments by reverse osmosis. (Sykes-IPC)
W77-12341

APPLICATION OF REVERSE OSMOSIS IN THE PULP AND PAPER INDUSTRY,
Institute of Paper Chemistry, Appleton, Wis.
I. K. Bansal, and A. J. Wiley.
National Research Council of Canada (Ottawa, Ontario, K1A 0R6), Publication No. 15627, p 459-480, 1977. 5 fig, 31 ref, 14 tab.

Descriptors: *Reverse osmosis, *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Waste treatment, Economics, Efficiencies, Pulp and paper industry, Membrane processes, Separation techniques, Energy.

Effective application of reverse osmosis is developing in the following areas of the pulp and paper industry: concentration and recovery of solutes from dilute process waters; recovery of high-quality clear water for return to the process water system and particularly in recycle systems; water volume control in the surges of closed recycle systems; removal of water from dilute solutions at reduced rates of energy consumption as compared with conventional change-of-phase systems of evaporation; and fractionation and improving the purity of solutes. Reverse osmosis process economics and efficiency data are reported. (Kykes-IPC)
W77-12342

ADVANCED WASTE LIQUOR TREATMENT AT TOTEN (CELLULOSEFABRIK A/S) WORLD'S FIRST FILTRATION INSTALLATION OF ITS KIND (AVANSERT LUTBEHANDLING PA TOTEN (CELLULOSEFABRIK A/S) LUTFILTRERING MED VERDEN'S FORSTE ANLEGG I SITT SLAG),
K. J. Gurandrud.
Norsk Skogindustri, Vol. 31, No. 4, p 98-100, April, 1977. 4 fig.

Descriptors: *Pulp wastes, *Waste water treatment, *Membrane processes, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Settling basins, Foreign countries, Europe, Treatment facilities, *Filtration, *Tertiary treatment.
Identifiers: *Hyperfiltration, Norway.

Both ammonium- and magnesium-base spent sulfite liquor is being treated (along with other discharged effluents) at this Norwegian sulfite pulp mill of about 40,000 tons/year capacity in a new fiber sedimentation basin and hyperfiltration installation. The latter comprises 14 modules of 392 sq m membrane area which operate at a pressure of about 4 MPa and reduce the effluent volume by 50%. (Brown-IPC)
W77-12343

WATER USAGE IN PAPER AND BOARD MILLS,
Jaakko Poyry Consulting Ltd., Sidcup (England).
For primary bibliographic entry see Field 3E.
W77-12344

MATERIALS BALANCE AND POLLUTION LOAD - EXAMPLE FROM THE PULP AND PAPER INDUSTRY (BILAN MATIERES ET FLUX DE POLLUTION - EXEMPLE DE L'INDUSTRIE DE LA PATE A PAPIER),
Groupement Europeen de la Cellulose, Paris (France).
For primary bibliographic entry see Field 5B.
W77-12345

PROCESSING OF COAGULATION SEDIMENTS OF TEXTILE INDUSTRY EFFLUENTS (BADANIA NAD PRZERABIANIEM OSADOW POKOAGULACYJNYCH ZE SCIEKOW PRZEMYSLU WLOKNIENICZEGO),
Centralne Laboratorium Dziewiarsstwa (Poland).
J. Roubia.
Przeglad Wlokienniczy, Vol. 31, No. 3, p 160-164, March, 1977. 5 fig, 8 ref, 4 tab.

Descriptors: *Textiles, *Waste water treatment, *Sludge treatment, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, *Coagulation, Iron compounds, Dewatering, Filtration, Burning, Hydrogen ion concentration, Polyelectrolytes, Filters, Lime, Wood wastes, Perlite, Sands, Aging (Physical).
Identifiers: Coal dust, Wood flour, Ferrous sulfate, Poland.

A laboratory and pilot-plant study was conducted on the processing of sediments obtained from textile industry effluents by coagulation with ferrous sulfate and a flocculant, gravity thickening, dewatering by filtration, and combustion. The sediments contained 99-99.5% moisture, 30-35% organic substances, and had a strongly alkaline pH. Dewatering was conducted by filtration through sand, by vacuum and pressure filtration, and by centrifugation. Thickening as a preliminary step to dewatering can be recommended because it facilitates filtration and gives filtrates of better quality. Gravity thickening is aided by the addition of polyelectrolytes adversely affected by aging of the sediment. The effectiveness of dewatering by filtration depends on the structure of the sediment, its initial water content, the type of filter material used, and the filtration method. Pressure filtration is recommended for industrial application. The addition of lime during coagulation imparts to the sediment a quasi-crystalline structure and improves its filterability. The use of filtration aids, such as coal dust, wood flour, or perlite, improves the structure of the sediment and facilitates filtration by reducing filtration resistance. Combustion as a final processing step can be conducted without additional drying of the dewatered sediments if coal dust is added to increase their calorific value. (Stapinski-IPC)
W77-12346

STUDIES ON THE TREATMENT OF SPENT LIQUORS FROM MITSUMATA AND MANILA HEMP PULPING, (IN JAPANESE),
M. Morimoto, T. Dobaski, K. Ikeda, and A. Takatsu.

Research Bulletin of the Printing Bureau, Ministry of Finance (Tokyo), No. 44, p 22-33, (10-21), (1976). 7 fig, 11 ref, 7 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Coagulation, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Bleaching wastes, Pulp and paper industry, Bark, Carbohydrates, Lignins, Chemical oxygen demand, Effluents, Waste treatment.
Identifiers: *Aluminum compounds, Mitsumata (Edgeworthia papyrifera), Manila hemp, Mannose, Japan.

Spent liquors from the pulping of Mitsumata (Edgeworthia papyrifera) bark (sample A) and manila hemp fiber (sample B), and manila hemp pulp bleaching effluents (sample C) were investigated for their chemical compositions and behavior during treatment with coagulants. Gas chromatography and UV absorption were used for the determination of carbohydrates and lignin, respectively. The relations between carbohydrates, lignin content, and COD were investigated. Treatment of the spent liquors with aluminum compounds reduced the carbohydrate contents of samples A, B, and C by 40, 65, and 70%, and the lignin contents by 70, 40, and 80%, respectively. Mannose was decomposed during pulping of Mitsumata bark. (Witt-IPC)
W77-12348

SORPTION OF SOLUBLE COMPONENTS OF PULP AND PAPER INDUSTRY EFFLUENTS BY ACTIVATED SLUDGE (ZAKONOMERNOSTI SORBTSSII RASTVORENNYKH KOMPONENTOV STOCHNYKH VOD TS(ELLYULOZNO-UMAZHNOY) (ROMYSHLENNOSTI) AKTIVNYM ILOM),
G. G. Litvinov.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tsellyulozno-Bumazhnoi Promyshlennosti, No. 67, p 131-139, 1975. 3 fig, 3 ref, 1 tab.

Descriptors: *Activated sludge, *Waste water treatment, *Pulp wastes, Effluents, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Waste treatment, Biological treatment, Sorption, Sulfite liquors, Hydrogen ion concentration, Adsorption, Temperature, Metabolism.
Identifiers: Mercuric chloride, Black liquors, Spent sulfite liquors.

This study of the sorption of effluent components by activated sludge was conducted using a solution of sugars in a concentration corresponding to that of sulfite pulp mill effluent, and diluted kraft black liquor from which lignin had been precipitated. The adsorption of the effluent components on the surface of cells was studied in the presence of mercuric chloride (to inhibit adsorption and enzyme activity). Adsorption (in the presence of the metabolism inhibitor) reached equilibrium in less than 1 min, and the adsorption capacity was 25-30 mg/g sludge for both types of effluent. Both the easily oxidizable and the difficultly oxidizable soluble components were absorbed on the cell surface. Adsorption took place by both physical and chemical mechanisms. Variations of the pH within the 3-10 range had no effect on the adsorption capacity, while a lowering of the temperature from 10 to 1°C increased adsorption, and a temperature of over 50°C lowered it. The total sorption capacity (in the presence of mercuric chloride) exceeded the adsorption capacity by 10 mg/g, on the average. Measurements of the rate of oxygen consumption by the cells indicated that glucose was metabolized at 1 mg/min. Thus, the rate of removal of pollutants is limited by the rate of metabolism. The sorption capacity of the sludge

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

depended on its degree of regeneration, and reached a maximum after 1-2 hr regeneration. (Stapinski-IPC)
W77-12350

SELECTION OF PARAMETERS FOR PROCESS CONTROL OF BIOLOGICAL PURIFICATION OF KRAFT MILL EFFLUENTS (VYBOR KANALOV UPRAVLENIYA PROTSESSOM BIOLOGICHESKOI OCHISTKI STOCHNYKH VOD SUL'FATSELYULOZNOGO PROIZVODSTVA),
V. F. Makarov, A. F. Milagin, N. E. Milagina, V. Z. Ponizovskii, and A. Ya. Rudomir.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tselyulozno-Bumazhnoi Promyshlennosti, No. 67, p 144-152, 1975. 1 fig, 8 ref, 3 tab.

Descriptors: *Pulp wastes, *Biological treatment, *Waste water treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Regression analysis, Biochemical oxygen demand, Activated sludge, Hydrogen ion concentration, Temperature, Nutrients, Pulp and paper industry, Effluents.
Identifiers: *Process control, Black liquors.

A static regression model was developed for the biological purification of kraft mill effluents in a displacement-type aeration tank. In order to limit the number of experiments, only the concentration of organic pollutants (in terms of 5-day BOD), the concentrations of activated sludge, and the residence time were used as the input variables. Other variables (pH, temperature, effluent to sludge volume ratio, and the BOD:N:P ratio) were either maintained at a definite level or remained uncontrolled. The experiments were conducted in laboratory equipment (which is described), using black liquor diluted to the desired level of BOD. The BOD was varied from 400 to 200 mg/liter, the activated sludge concentration from 1 to 2 g/liter, and the residence time from 3 to 6 hr. The regression model correlates the three input variables with the output variables (BOD at the outlet of the aeration tank). The validity of the model was confirmed by additional experiments, in which the experimental and calculated data were compared. In selecting the controlling factors, preference should be given to the flow rate or the concentration of the effluent at the inlet of the aeration tank. (Stapinski-IPC)
W77-12351

EFFECT OF A SURFACE-ACTIVE AGENT ON THE BIOLOGICAL PURIFICATION OF INDUSTRIAL EFFLUENTS (VLIYANIE POVERKH-NOSTNOAKTIVNOGO VESHCHESTVA NA PROTSESS BIOLOGICHESKOI OCHISTKI PROMSTOKOV),
M. A. Lomova, I. M. Kas'yanik, V. M. Poletaeva, and N. Ya. Voronchikhina.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tselyulozno-Bumazhnoi Promyshlennosti, No. 67, p 152-155, 1975. 1 fig.

Descriptors: *Pulp wastes, *Activated sludge, *Surfactants, *Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Water pollution source, Waste treatment, Pulp and paper industry, Effluents, Foreign countries, Foaming, Biological treatment.
Identifiers: USSR, Black liquors, Spent sulfite liquors.

The nonionic surfactant Prevocell W-OF-100 (produced by hydroxyethylation of a mixture of aliphatic alcohols) is used at the Amur (USSR) board mill to increase the bleaching quality of the pulp and reduce pitch problems. To determine the action of the surfactant on the biological purification of effluent, experiments were conducted in which effluents from the Amur mill and the Kotlas pulp and paper mill, and also model spent sulfite

liquors and black liquors, were treated by the activated sludge process in the presence of various amounts of the additive. When present in more than 5 mg/liter, the surfactant partially inhibited the process and lowered the quality of the activated sludge. When the sludge was adapted to the surfactant, no detrimental effects were observed. Because of the foaming tendency of Prevocell, it is recommended that its concentration in the effluent not exceed 2-3 mg/liter. (Stapinski-IPC)
W77-12352

EFFECT OF DEPARTMENT DISCHARGES ON THE CHEMICAL PURIFICATION OF INDUSTRIAL EFFLUENT. PART 1. DISCHARGE OF A YEAST-PRODUCING PLANT -- SPENT FERMENTATION LIQUOR (O VLIYANII TSEKHOVYKH STOCHNYKH VOD NA PROTSESS KHIMICHESKOI OCHISTKI PROMSTOKOV. SOOBSHCHENIE 1. STOK DROZHZHEVOGO PROIZVODSTVA -- POSLEDROZHZHEVAYA BRAZHKA),
Yu. I. Chernousov, V. N. Kostygin, M. L. Murshaya, and A. V. Boguslavskaya.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tselyulozno-Bumazhnoi Promyshlennosti, No. 67, p 155-160, 1975. 3 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Yeasts, *Fermentation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Foreign countries, Color, Coagulation, Chemical precipitation, Effluents, Pulp and paper industry, Lignins.
Identifiers: USSR, Aluminum sulfate, Kraft mills.

The effluents of the Baikal (USSR) kraft mill are treated with aluminum sulfate to precipitate the colored substances (lignin-type compounds of high molecular weight). The effectiveness of decolorization is 95-98%. The prehydrolyzate from the production of prehydrolysis-kraft pulp is utilized at the mill for the production of yeast. On the assumption that the periodically observed difficulties in decolorization of the kraft mill effluent are due to the addition of spent fermentation liquor to the effluent, experiments were conducted in which biologically purified mill effluent containing 1.5-3% spent fermentation liquor, mill effluent purified biologically jointly with an equal amount of spent fermentation liquor, mill effluent alone, and spent fermentation liquor alone were coagulated with aluminum sulfate. In the case of the spent fermentation liquor, the maximum decolorization, even at high doses of aluminum sulfate, did not exceed 70-80%. The addition of this liquor to the kraft mill effluent lowered the decoloration efficiency. The spent fermentation liquor should be treated separately at the yeast-producing plant, or evaporated. (Stapinski-IPC)
W77-12353

POTENTIOMETRIC DETERMINATION OF MICROAMOUNTS OF SULFUR COMPOUNDS IN KRAFT MILL EFFLUENTS (POTENTSIOMETRICHESKOE OPREDELENIE MIKROKOLICHESTV SERNISTYKH SOEDINENII V STOCHNYKH VODAKH SUL'FATSELYULOZNOGO PROIZVODSTVA),
For primary bibliographic entry see Field 5A.
W77-12354

CHARACTERISTICS OF A FLUIDIZED BED AND ITS EFFECT ON THE COURSE OF THE FLOTATION PROCESS (KHARAKTERISTIKA PENNOGO SLOYA I EGO VLIYANIE NA KHOD FLOTATSIONNOGO PROTSESSA),
V. A. Kopylov, G. P. Kuchin, and R. A. Solonitsyn.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tselyulozno-Bumazhnoi Promyshlennosti, no 67, p 164-169, 1975. 3 fig, 1 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Flotation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Effluents, Pulp and paper industry, Water purification, Foreign countries.
Identifiers: *White water (Paper machines), *Savealls, USSR.

The fluidized bed formed during flotation of effluent consists of gas, a liquid phase, and solid particles. The operation of flotation savealls depends not only on the nature of suspended particles, the amount and dispersity of the air bubbles, the nature and amount of coagulants and flocculants used, and the residence time of the effluent in the saveall, but also on the properties of the fluidized bed formed in the saveall. These properties are discussed, and experimental curves are presented showing the dependence of the fluidized-bed concentration and of the bubble dimensions on the bed height. The height of the fluidized bed necessary for effective operation depends on the nature of the suspended solids, and the amount of air fed must be optimum for each system. The scraper's rate of movement should not exceed 10 mm/sec, and to prevent demineralization (separation of solid particles from the air bubbles), only the upper part of the bed should be removed. On the basis of these considerations, a laboratory continuous flotation saveall was constructed, in which the height of the fluidized bed can be controlled. This saveall was tested on white water from paper machines producing several types of paper at the Krasnogorod paper mill and on the activated sludge at the Syasya mill. A satisfactory recovery was obtained without the use of coagulating and flocculation agents. (Stapinski-IPC)
W77-12355

PRESSURIZED PIPELINE TRANSPORT OF EFFLUENT SEDIMENTS (K VOPROSU PEREKACHKI OSADKOV STOCHNYKH VOD PO NAPONNYM TRUBOPROVODAM),
V. A. Fetisov, G. P. Kuchin, and G. A. Romanov.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tselyulozno-Bumazhnoi Promyshlennosti, No. 67, p 169-178, 1975. 5 fig, 6 ref, 4 tab.

Descriptors: *Lignins, *Slurries, *Pipe flow, *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Water pollution sources, Foreign countries, Rheology, Shear drag, Viscosity, Non-Newtonian flow, Flow, Flow characteristics, Flow rates, Closed conduit flow.
Identifiers: USSR.

This report deals with the problem of transport of a lignin slurry, precipitated from pulp mill effluents, through pressurized pipelines, including the pressure losses during transport. The pressure head losses were studied in experimental equipment mounted on the purification facilities of the Baikal (USSR) pulp mill, with slurries ranging in concentration from 0.1 to 26.6 g/liter, at flow rates from 0.1 to 4.3 m/sec, and temperatures from 4 to 12°C. Also studied were the rheological properties of the lignin slurry (viscosity and resistance to shear). The pipeline diameters were 100, 135, and 200 mm. The study showed that the lignin slurry is a non-Newtonian liquid and that its behavior during transport in the pressurized pipeline can be described by Buckingham's equation with sufficient accuracy for practical purposes. The standard SNIP II-G.6-62 (used for sewage pipelines) is recommended for calculations of the pipelines, taking into account the composition of the slurry and its rheological properties. For a slurry containing 40-50% alkali lignin, 15-25% fibers, and 10-15% activated sludge, the critical flow rate is 0.3-0.4 m/sec higher than for municipal sewage. (Stapinski-IPC)
W77-12356

EXPERIMENTAL EQUIPMENT FOR CULTIVATION OF ACTIVATED SLUDGE UNDER CONDITIONS OF CONSTANT OXIDATION POTENTIAL (EKSPERIMENTAL'NAYA USTANOVKA DLYA KULTIVIROVANIYA AKTIVNOGO ILA V USLOVIYAKH POSTOYANSTVA OKISLITEL'NOGO POTENTIALA), V. G. Krunchak, V. I. Poddubnyi, and R. I. Sosnovskii. Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tsellyulozno-Bumazhnoi Promyshlennosti, No. 67, p 178-182, 1975. 1 fig, 9 ref.

Descriptors: *Activated sludge, *Pulp wastes, *Waste water treatment, Laboratory equipment, *Oxidation-reduction potential, Wastes, Industrial wastes, Water pollution sources, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Pulp and paper industry, Waste treatment, Water temperature, Effluents, Biological treatment, Effluents.

Identifiers: Black liquors, Kraft mills.

A review of the literature shows that information concerning the effects of redox potential on the course of the biochemical oxidation process is insufficient and frequently contradictory. Experimental equipment for cultivation of activated sludge was designed. Stationary culture conditions are achieved by systems controlling the redox potential, level of dissolved oxygen, and the temperature. Since biochemical purification is used in the paper industry mainly for kraft mill effluents, the experiments were conducted on a model solution of black liquor containing, in g/liter, 1.12 vanillin, 0.93 sodium acetate, and 0.74 oxalic acid. The 5-day BOD of this solution was 330 mg/liter, and was equal to COD, since all components were easily oxidized. The redox potential in the cultivator was kept constant at +40 mv, the concentration of dissolved oxygen at the saturation level (i.e., about 7.5 mg/liter), and the temperature at 20°C. Measurements of BOD at the inlet and the outlet showed that the equipment operates under stationary conditions, indicating a constant composition of the activated sludge. (Stapinski-IPC)

W77-12357

WORK OF CENTROPJECT ON THE PROBLEMS OF TEXTILE EFFLUENT TREATMENT (PROBLEMATIKA CISTENI TEXTILNICH ODPADNICH VOD A JEJI RESENI V CENTROPJEKTU), Centropjekt, Gottwaldov (Czechoslovakia). J. Nosek. Textil, Vol. 31, No. 12, p 463-465, 1976. 2 fig, 2 illus, 11 ref, 1 tab.

Descriptors: *Textiles, *Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Dissolved solids, Suspended solids, Water temperature, Treatment facilities, Sludge disposal, Sludge, Tertiary treatment, Biochemical oxygen demand, Biological treatment, Dewatering, Effluents.

Textile industry effluents contain a mixture of waste materials such as lanolin originated from raw materials or various additives. Resource conservation efforts result in the discharge of less effluent, sometimes with higher concentration of dissolved and suspended solids, and elevated temperature. Several successfully engineered projects by Centropjekt included effluent heat recovery, regeneration of chemicals such as caustic soda, and recovery of lanolin. Textile industry effluent treatment plants usually include an equalization stage, mechanical and biological treatment stages with sludge handling and disposal. Also a tertiary chemical stage was required in some cases. Since the BOD became the main criterion of effluent quality, biological treatment is required in a majority of cases, though chemical treatment is more versatile and reliable. The most difficult part of the design is usually the secondary sludge dewatering section. (Trubacek-IPC)

W77-12359

CHEMICAL CONCENTRATION BY ADSORPTION, Flambeau Paper Co., Park Falls, Wis. (Assignee). K. W. Baiert. United States Patent No 4,016,180. April 5, 1977. 20 p, 5 fig, 32 claims, 21 tab.

Descriptors: *Patents, *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, *Adsorption, Activated carbon, Distillation, Energy, Effluents, Separation techniques.

Identifiers: Spejt sulfite liquors.

A low-cost two-stage adsorption-desorption method of concentrating dilute supplies of chemicals is provided which uses a minimum of energy in the form of process steam and yields highly concentrated supplies of end products which are suitable for reuse or sale. The method is particularly adapted for concentrating waste condensates derived from pulp-making operations such as the kraft or sulfite process, but in general is also applicable to the treatment of all types of dilute organic or inorganic adsorbable chemicals. The invention involves first adsorbing a chemical fraction from a dilute stream onto activated carbon; regenerating the adsorbed chemicals and concentrating them by fractional distillation; again subjecting the partially concentrated chemicals to adsorption, regeneration, and fractional distillation concentration; and then recovering the product. Sulfite process waste condensates containing minor amounts of acetic acid, methanol, furfural, and sulfur dioxide may be treated by the process to yield concentrated quantities of acetic acid, ethyl acetate, or furfural. (Lynch-IPC)

W77-12360

PROCESSING CHANGES AND CLOSED SYSTEMS DESIGNED FOR MINIMUM EFFLUENT DISCHARGE FROM THE MANUFACTURE OF PAPER PULP (PROCESSANDRINGAR OCH SLUTNA SYSTEM FOR ATT MINSKA UTSLAPP FRAN TILLVERKNING AV PAPPERSMASSA), IVI Konsult A.B., Stockholm (Sweden). H. Norrstrom, E. Stenberg, and G. Akerlund.

Descriptors: *Pulp and paper industry, *Discharge(Water), Water conservation, Wastes, Industrial wastes, Water pollution sources, Foreign countries, Water consumption(Except consumptive use), Biochemical oxygen demand, Suspended solids, *Pulp wastes, Water pollution, Color, Effluents, Europe.

Identifiers: Sweden, Closed systems, Process modifications, Kraft mills.

Effluent discharges from the pulp and paper industry represent the main water pollution source in Sweden. In 1974 the total water consumption was about 2,000,000,000 cu m/year and the discharges of 7-day BOD and suspended solids at about 375 kt/year and 100 kt/year, respectively. About one-half of these amounts were generated in the production of kraft pulp and paper and board products. The processes of bleached kraft pulp manufacture, debarking, pulp washing and screening, condensate handling, and oxygen bleaching are all discussed with respect to possibilities for minimizing effluent discharges. It is shown that it is presently possible to reduce 7-day BOD to 18 kg and colored compounds to 90 kg/ton of pulp produced. Future possibilities for further reductions by means of process modifications and closing of systems are outlined. (Speckhard-IPC)

W77-12361

TREATMENT OF EFFLUENT FROM A PULP AND PAPER MILL THROUGH OZONE AND THE ACTIVATED SLUDGE PROCESS (DIE BEHANDLUNG DES ABWASSERS EINER ZELL-

STOFF- UND PAPIERFABRIK MITTELS OZON UND BELEBTSCHLAMMVERFAHREN), Chemisch und Biologisches Laboratorium, Essen (West Germany). P. Koppe, H. Herkelmann, and G. Sebesta. Vom Wasser, Vol. 46, p 221-239, 1976. 16 fig, 13 ref, 5 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Activated sludge, *Ozone, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Waste treatment, Chemical oxygen demand, Biochemical oxygen demand, Biological treatment, Energy, Costs, Lignins, Effluents.

Studies are presented on the ozonization of calcium lignosulfonate (change in COD and BOD as a function of time), the ozonization of pulp and paper mill effluents coupled with subsequent biological treatment in an activated sludge plant, and the ozonization of pulp and paper mill effluents sandwiched between biological treatments. While ozonization was found to result in substantial reductions in effluent BOD, an examination of energy costs indicates the need for further research aimed at improving the efficiency of ozonization before such effluent treatment processes can become competitive. (Speckhard-IPC)

W77-12362

POTABLE WATER FROM WASTEWATER—DENVER'S PROGRAM, S. J. Hadeed. Journal Water Pollution Control Federation, Vol. 49, No. 8, p 1757-1758, August, 1977.

Descriptors: *Water reuse, *Return flow, *Water supply development, *Cost comparisons, *Tertiary treatment, Water treatment, Water sources, *Waste water treatment, Potable water, Pilot plants, Environmental effects.

Identifiers: Denver(CO).

Although the reuse of waste water has been examined extensively for applications in irrigation, industry, recreation, and groundwater recharge, the reuse of waste water for drinking purposes has not often been considered. Plans for a pilot study in Denver, Colorado, using a 1 mgd potable quality demonstration plant are discussed. The program, which may eventually lead to a full-scale 100 mgd plant scheduled for operation in the early 1990's, will include extensive water quality monitoring and health and toxicological studies. As water supplies must be transported to Denver and demands may exceed existing supplies by 1980, the use of high-quality effluents as a source of potable water may be more cost-effective than importation. Pilot operations will include constant monitoring of effluent quality over a 5 to 15 year period during which reclaimed waste water will be used for industrial and recreational purposes. Construction costs for the pilot plant are estimated at \$8.3 million, and \$95 to \$150 million for the full-scale facility. A public opinion survey on the reuse of waste water for drinking purposes revealed that 63% of the respondents did not object to water reuse, 25% were against the concept, and 12% were undecided. (Schulz-FTRL)

W77-12395

NEW OXYGEN METERS. For primary bibliographic entry see Field 5A. W77-12399

REGIONALIZING WASTEWATER FACILITIES ON THE OREGON COAST, Depoe Bay Sanitary District, Oreg. R. F. Jackson, W. Hackworth, and F. H. Barrett Jr. Public Works, Vol. 108, No. 8, p 68-71, August, 1977. 2 fig.

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Group 5D—Waste Treatment Processes

Descriptors: *Sewerage, *Regional development, *Interceptor sewers, *Activated sludge, *Treatment facilities, Sewage treatment, Sewage disposal, Municipal wastes, *Waste water treatment, *Oregon.

Identifiers: Depoe Bay(OR), Gleneden Beach(OR).

The coastal communities of Depoe Bay and Gleneden Beach, Oregon have investigated alternatives to ocean discharge of untreated wastes. The Gleneden Beach and Depoe Sanitary Districts adopted a master plan for sewage treatment and disposal which provided for interconnection of the two systems and a common treatment facility. The treatment facility in Depoe Bay was designed to accommodate fluctuations in loading caused by the area's tourist industry, and uses a two-part complete-mix activated sludge processing system which can be partially shut down during periods of low flow. The Gleneden District is serviced by 750,000 feet of sewer lines and nine pumping stations which direct sewage to the Depoe plant via a common interceptor system. The Depoe collection system includes 35,000 feet of sewer lines and three pumping stations. Construction costs for the regional facilities included \$1.6 million for the Depoe project and \$1.3 million for the Gleneden collection and interceptor systems. (Schulz-FIRL) W77-12400

DUAL WATER SYSTEMS -- DESIGN,

P. D. Haney, and F. K. Beatty.

American Water Works Association Journal, Vol. 69, No. 7, p 389-398, July, 1977. 5 fig, 14 tab, 25 ref.

Descriptors: *Water reuse, *Impaired water reuse, *Water sources, *Water treatment, *Dual system, *Waste water treatment, Costs, Cost comparisons, Design criteria, Water pollution, Water quality, Demineralization.

Various aspects of dual water systems, separate facilities designed to provide potable and nonpotable water, are presented. An historical review of the concept of dual water systems and their role in maintaining adequate water supplies in the future are discussed. The possibility of accidental cross-connection of potable and nonpotable water is considered. Water quality standards dependent upon planned use are evaluated. Adverse effects of substandard water caused by pathogenic organisms or trace elements are discussed. Cost estimates for dual and conventional systems employing demineralization by electrodialysis, activated carbon filtration, and chlorination of groundwater are compared, including amortization, operation, and maintenance costs. It is suggested that dual systems are advantageous in areas where expensive treatment methods such as demineralization are indicated or where water resources are limited. Comparative installation costs and service are given for seven midwestern utilities. The average daily use of nonpotable water ranged from 0.37 cu m/capita per day to 0.916 cu m/capita per day. Reclaimed waste water is suggested as a source of nonpotable water, provided that other sources are available to supplement the average daily waste water flow of 0.38 cu m/capita per day. (Schulz-FIRL) W77-12402

EFFECTS OF TREATED MUNICIPAL WASTE WATER ON GROWTH, FIBER, PROTEIN, AND AMINO ACID CONTENT OF SORGHUM GRAIN,

Arizona Univ., Tucson. Dept. of Plant Sciences.

For primary bibliographic entry see Field 5E. W77-12404

REDUCTION OF AQUEOUS FREE CHLORINE WITH GRANULAR ACTIVATED CARBON-PH AND TEMPERATURE EFFECTS,

Georgia Inst. of Tech., Atlanta. School of Civil Engineering.

M. T. Suidan, V. L. Snoeyink, and R. A. Schmitz. Environmental Science and Technology, Vol. 11, No. 8, p 785-789, August, 1977. 5 fig, 12 ref.

Descriptors: *Activated carbon, *Packed beds, *Chlorine, *Mathematical models, *Kinetics, Chemical reactions, Adsorption, Thermodynamic behavior, Equilibrium, Chlorination, Hydrogen ion concentration, Temperature, Water treatment, *Waste water treatment. Identifiers: Granular activated carbon.

The effects of pH and temperature on HOCl and OCl(-) reactions with activated carbon were examined with the aid of a mathematical model previously developed by the authors. The behavior of packed carbon beds was examined at various pH and temperature values. Chemical and mathematical relationships were described. Experimental methods and materials for batch tests and packed bed experiments were outlined. A determination of rate constants for the disappearance of free chlorine from blank reactors indicated that disappearance of chlorine followed first order kinetics. Equilibrium constants and speciation for HOCl and OCl(-) were examined at pH values of 4.0, 7.6, and 10.0. The pH was observed to affect the distribution of free chlorine between HOCl and OCl(-) but did not appreciably affect reaction rates. A dissociation constant for free chlorine on the carbon surface of 10.5 kcal/mole was calculated on the basis of temperature data. The values of constants in the mathematical model were suggested as useful in the prediction of behavior for packed bed reactors with respect to pH, temperature, influent concentration, particle size, and flow rate. (Schulz-FIRL) W77-12405

A MODEL TO PREDICT CONCENTRATION AND HEAD-LOSS PROFILES IN FILTRATION,

Iowa State Univ., Ames. Dept. of Civil Engineering.

A. Adin, and M. Rebhun.

Journal of the American Water Works Association, Vol. 69, No. 8, p 444-453, August, 1977. 17 fig, 2 tab, 22 ref.

Descriptors: *Filtration, *Mathematical studies, *Computer models, *Separation techniques, *Forecasting, Filters, Flocculation, Packed beds, Porous media, Design, Flocculation, *Waste water treatment.

Identifiers: Contact filtration, High-rate filtration, Filter performance, Filter head-loss.

A mathematical model has been developed for the study, evaluation, and prediction of contact filter performance. A material-balance relationship and an equation for filtration kinetics were derived. A computer program was developed to predict concentration-filtrate volume profiles for different filtration parameters. Model performance was tested against experimental data from filtration of a kaolinite suspension through deep granular beds where alum or a cationic polyelectrolyte was applied as a flocculant. Breakthrough curves were examined for different bed depths under various conditions with a small pilot filter, and then related to an accumulation-detachment model. Parameters used in the model include filter capacity, hydraulic conductivity, and accumulation and detachment coefficients. The predictive mathematical model can be used for various waters, filter beds, and flocculants to estimate concentration and head-loss profiles for engineering design. (Schulz-FIRL) W77-12406

ACTIVATED SLUDGE PROCESS DESIGN,

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

D. T. Lauria, J. B. Uunk, and J. K. Schaefer.

Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 103, No. EE4, p 625-645, August, 1977. 6 fig, 2 tab, 12 ref.

Descriptors: *Mathematical models, *Activated sludge, *Efficiencies, *Optimization, *Design criteria, Costs, Aeration, Sludge treatment, Biochemical oxygen demand, Dewatering, Settling basins, *Waste water treatment.

Identifiers: Activated sludge process efficiency.

Various considerations for the mathematical evaluation and empirical modelling of activated sludge process design are described, with emphasis on the completely mixed steady-state activated sludge process. A series of biological process equations is presented for the determination of BOD removal rates, net excess sludge production, and process efficiency. Oxygen requirements are then related to demand and rate of use as determined by previous calculations. The required settling tank area for adequate thickening is calculated on the basis of solids loading and underflow concentration. Process variables and parameters are defined and listed in tabular form. Process efficiency ratings are considered for the amount of sludge under aeration and the net excess solids, including other variables such as BOD loading, sludge age, and a waste sludge factor. Because the process is defined by six decision variables and four equations, the number of degrees of freedom available to the process designer and the effect of fixing variables such as aeration tank volume and mixed liquor solids concentration are discussed. Formulas for construction and operation costs are derived on the basis of decision variables. Examples of numerical values of decision variables (BOD removed, net excess sludge, sludge under aeration, oxygen, BOD loading factor, BOD utilization factor, sludge, and waste sludge factor) calculated for various process efficiencies are given. Practical limitations on empirical modelling of the activated sludge process for maximum efficiency are discussed. (Schulz-FIRL) W77-12407

CONTROL STRATEGIES FOR THE ACTIVATED SLUDGE PROCESS,

Flanagan and Associates, San Francisco, Calif.

M. J. Flanagan.

Instrumentation Technology, Vol. 24, No. 7, p 35-43, July, 1977. 5 fig, 5 ref.

Descriptors: *Activated sludge, *Automatic control, *Oxidation, *Biodegradation, *Settling basins, Sludge treatment, Oxygen requirements, Sewage treatment, Sewage effluents, Biochemical oxygen demand, Fluctuations, Equipment, Remote control, *Waste water treatment. Identifiers: Activated sludge process control.

Improved automatic control of the activated sludge process has been suggested to increase process performance and efficiency, particularly in the treatment of wastes with large diurnal and seasonal variations. In order to maintain the food-to-microorganism ratio within the acceptable operating limits, increases in plant flow and solids loading must be controlled to prevent overburdening of the oxidation and sedimentation tanks. A suggested solution to the oxidation-sedimentation interaction is to provide storage during peak flow, larger sedimentation tanks to accommodate diurnal fluctuations, and separate oxidation and sedimentation processes. Since many facilities are not equipped with return activated sludge facilities or sufficient storage space in sedimentation tanks, three additional control strategies are described: return activated sludge storage facilities, and variable-speed pumping between storage and oxidation tanks with optimal step-feed control gates; oxidation tanks equipped with power-actuated step-feed control gates; and sedimentation tanks equipped with power-actuated step-feed control gates. All three contain a feedforward-feedback air supply control system which is activated by on-line measurements of dissolved oxygen levels and oxygen demand, as determined by dissolved oxygen probes and a respirometer. (Schulz-FIRL) W77-12409

EVALUATION OF A COMPREHENSIVE KINETIC MODEL FOR THE ACTIVATED SLUDGE PROCESS.

Colorado Univ., Boulder. Dept. of Civil, Environmental, and Architectural Engineering. L. D. Benefield, and C. W. Randall. Journal Water Pollution Control Federation, Vol 49, No 7, p 1636-1641, July, 1977. 6 fig, 12 ref.

Descriptors: *Mathematical models, *Activated sludge, *Biomass, *Forecasting, *Effluents, Operations research, Mathematical studies, Sludge treatment, Kinetics, Model studies, Water Pollution Control Federation, *Waste water treatment. Identifiers: Grau-Dohanyos model.

Mathematical models have been used to predict steady-state biomass and effluent substrate concentrations for completely-mixed, suspended growth, biological processes with and without cellular growth. Limitations of previously used models are discussed, and a model to adequately describe process kinetics under conditions outside the limits of other models is presented. Previous models have assumed that effluent and influent substrate concentrations are independent, whereas investigations of the treatment of organic substrates by mixed microbial cultures have indicated otherwise. This relationship, if valid, would necessitate changing mean cell residence times to compensate for variations in influent substrate concentration. It is suggested that mean cell residence time may not be useful as a control parameter for plant operation where the influent substrate varies. (Schulz-FIRL) W77-12410

PERFORMANCE OF STORM DRAINAGE SIMULATION MODELS.

P. J. Colyer. Proceedings of the Institution of Civil Engineers, Part 2, Vol 63, p 293-309, June, 1977. 3 fig, 3 tab, 33 ref.

Descriptors: *Computer programs, *Mathematical models, *Simulation analysis, *Storm runoff, *Water management(Applied), Sewerage, Urban hydrology, Drainage systems, Hydrograph analysis, Sewers, Analytical techniques, Storm water, *Waste water treatment. Identifiers: Storm drainage simulation models, TRRL.

Various storm drainage models were evaluated for accuracy in simulated observed storm events. Models examined included: rational (Lloyd-Davies) method; direct method; inlet method; lumped hydrologic methods; Transport and Road Research (TRRL) method; East African modification of TRRL (TRRL(EA)); Illinois urban drainage area simulator (ILLUDAS); Massachusetts Institute of Technology (MIT) method; University of Cincinnati urban runoff (UCUR) method; hydrograph volume method (HVM); EPA storm water management model (SWMM); and the Illinois storm sewer system simulation (ISS) model. Numerical parameters were used to determine accuracy in performance using observed and calculated values for hydrologic variables such as peak discharge, time to peak, and total runoff volume. Among the numerical parameters used were: lambda, the ratio between calculated and observed values; epsilon, the absolute error between individual calculated and observed values; and epsilon calculated for groups of positive and negative errors. Calculations indicated that storm sewer models can predict peak discharge and runoff volume within 10-20%. The TRRL method was capable of the most accurate overall performance of the models examined. Suggestions for improvement in storm drainage models include closer examination and field studies to better determine the limitations of simulation models, more efficient programming to reduce costs to the user, and the addition of other parameters such as surcharging, backwater effects, and surface flooding. (Schulz-FIRL)

W77-12411

THE TECHNICAL-ECONOMIC MODEL OF WATER QUALITY IN THE SAJO RIVER (A SAJO VIZMINOSEGI MUSZAKI-KOZGAS-DASAGI MODELLJE).

Karl Marx Univ. of Economics, Budapest (Hungary). For primary bibliographic entry see Field 5G. W77-12413

POLYCHLORINATED BIPHENYL CONCENTRATION IN SEWAGE AND SLUDGES OF SOME WASTE TREATMENT PLANTS IN SOUTHERN ONTARIO.

Canada Centre for Inland Waters, Burlington (Ontario). For primary bibliographic entry see Field 5B. W77-12414

METERING TOTAL OXYGEN DEMAND, Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands). Application Lab.

For primary bibliographic entry see Field 5A. W77-12416

THE USE OF A MACRORETICULAR RESIN XAD-2 FOR THE RECOVERY OF VOLATILE ORGANIC COMPOUNDS FROM MUNICIPAL SEWAGE.

Health and Welfare Canada, Vancouver (British Columbia). Pesticide Lab. B. T. Mori, and K. J. Hall. Journal of Environmental Science and Health, Vol A12, No 7, p 341-351, July, 1977. 2 fig, 2 tab, 22 ref.

Descriptors: *Separation techniques, *Solvent extractions, *Phenolic pesticides, *Detergents, Chemical wastes, Sewage treatment, Organic compounds, Organic wastes, *Resins, Hydrogen ion concentration, Municipal wastes, *Waste water treatment. Identifiers: Macroreticular resin XAD-2.

The extraction ability of a macroreticular resin XAD-2 for the removal of volatile organics in municipal sewage was investigated, with special emphasis on the effects of pH and detergents, adsorption of volatiles on sewage particulates, and resin capacity. Experimental procedures for laboratory studies on the extraction of chlorinated phenols and detergent are described. Studies indicated that phenol removal was not affected by changes in pH, but decreasing the pH from 7.1 to 1.8 increased detergent recovery from 4 to 40 percent. Phenol extraction efficiencies were greater with a distilled water matrix than with municipal sewage. In addition, adsorption of phenols onto plastic surfaces was greater when sewage was the solvent. Breakthrough studies indicated that lowering the pH of the sewage from 7.2 to 2.0 lowered the breakthrough point from 133 to 120 column volumes and raised total organic carbon recovery from 19 mg/liter to 25 mg/liter. Resin capacity was 1.7 mg total organic carbon/cc of resin and was not affected by pH. (Schulz-FIRL) W77-12417

HIGH ENERGY ELECTRON IRRADIATION OF WASTEWATER LIQUID RESIDUALS, Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.

A. J. Sinskey. Process Biochemistry, Vol 12, No 5, p 11-14, 32, June, 1977. 7 fig, 4 tab, 8 ref.

Descriptors: *Irradiation, *Disinfection, *Sewage bacteria, *Coliforms, *Viruses, Model studies, Pilot plants, Shigella, Salmonella, Oxygen, Nitrogen, Microorganisms, Sludge treatment, Sludge disposal, Fertilizer, *Waste water treatment.

Identifiers: Deer Island Waste Water Treatment Plant(Boston MA).

Land application of municipal waste water sludge for fertilizer and the possibility of contamination by enteric viruses which may survive conventional waste treatment processes have prefaced this investigation into the design and use of electron irradiation for waste water disinfection. The rate of inactivation of bacteria, viruses, and parasites, as well as the required radiation dosage for adequate disinfection, was examined for raw primary sludge, anaerobically digested sludge, secondary waste-activated sludge, dewatered sludge, and composted sludge. Design data for the irradiation facility at Deer Island in Boston are presented. Sludge was irradiated in a concrete-shielded vault as it passed over a rotating stainless steel drum. Microbial survival was not related to sludge soils contents, which ranged from 1.4 to 22 percent. Inactivation studies on Salmonella and Shigella indicated that a dosage of 200 krad was sufficient to reduce levels below detection limits. A dose of 210 krad eliminated fecal streptococci in digested sludge. Coliforms and gram negative bacteria were reduced by a six log cycle with a radiation dose of 150 krad. Greater reductions in bacteria were observed for irradiation in the presence of oxygen at 1 atm than for nitrogen or air at 1 atm. Preliminary cost estimates for incorporating radiation disinfection at the 10,000 gpd Deer Island facility were a capital cost of \$45,000 and annual operating costs of \$130,000, or \$17 per ton of dry sludge. (Schulz-FIRL) W77-12419

PHOSPHATE REMOVAL FROM SEWAGE WATER BY SOIL COLUMNS.

Agricultural Research Service, Phoenix, Arizona. Water Conservation Lab. J. C. Lance. Journal of Environmental Quality, Vol 6, No 3, p 279-284, July-September, 1977. 8 fig, 1 tab, 13 ref.

Descriptors: *Filtration, *Phosphates, *Sands, *Soil filters, *Groundwater recharge, *Bermudagrass, Effluents, Sewage treatment, Artificial recharge, Return flow, Water reuse, Adsorption, Chemical precipitation, Infiltration, Permeable soils, Soil-water-plant relationships, Waste water treatment. Identifiers: Calcareous sands, Phosphate removal.

Phosphate removal from secondary sewage effluent by calcareous sand filters was investigated as a means of waste water renovation by high-rate land filtration. Columns packed with loamy sand were flooded with secondary sewage effluent for various time periods and infiltration rates. Infiltration rate was the major factor controlling phosphate removal, producing lower phosphate concentrations in filtrate with lower flow velocities. Phosphate content in filtrate could be increased by the addition of dextrose to the column to decrease infiltration rate. Suggested mechanisms for phosphate removal include initial adsorption by the column soil and subsequent precipitation as some form of calcium phosphate. Initial phosphate concentrations of column filtrate were low (0.5 to 1.0 ppm) for more than 200 days of flooding, and leveled off at equilibrium concentrations dependent upon the various filtration rates. Phosphate removal decreased when Bermudagrass (Cynodon dactylon) was grown in the soil columns, suggesting that plant roots kept phosphate in solution through Ca chelation, Ca uptake by plants, competition of organic ions with phosphate for adsorption sites, or a pH reduction in the rhizosphere. Studies indicated that up to 80% of the phosphate in sewage water can be removed by calcareous sand filters at infiltration rates below 15 cm/day. (Schulz-FIRL) W77-12420

REMOVAL OF PHOSPHATE BY POWDERED ALUMINUM OXIDE ADSORPTION,

Delaware Univ., Newark.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

C. P. Huang.

Journal Water Pollution Control Federation, Vol 49, No 8, p 1811-1817, August, 1977. 8 fig, 1 fig, 25 ref.

Descriptors: *Phosphates, *Nutrient removal, *Aluminum, *Adsorption, *Kinetics, Hydrogen ion concentration, Chemical reactions, Tertiary treatment, Sewage treatment, Electrophoresis, Separation techniques, *Waste water treatment. Identifiers: Gamma-Al₂O₃, Aluminum oxide, Adsorption kinetics.

The feasibility of the use of powdered aluminum oxide for the removal of phosphate at dilute concentrations was examined. A commercial product, manufactured by the Cobalt Company in Boston, consisting of approximately 90% gamma-Al₂O₃ was used in laboratory adsorption experiments with NaH₂PO₄. The two major factors which were observed to affect phosphate removal efficiency were pH and the relative concentration of phosphate to alumina. Phosphate levels were reduced to below detection limits (0.1 mg/liter) at low phosphate:alumina ratios, but remained at 2 mg/liter with an increase of the phosphate:alumina ratio to 0.01. The pH range for optimal phosphate removal was also controlled by the phosphate:alumina ratio, narrowing with increasing ratios. Studies on the kinetics of phosphate removal indicated that phosphate removal was very rapid during the first hour of reaction, and decreased after the second hour to a linear relationship. Specific rate constants and initial rates as affected by pH and phosphate:alumina ratio are listed. Electrokinetics studies indicated that phosphate adsorption modified the electrophoretic mobility of gamma-Al₂O₃. The use of powdered gamma-Al₂O₃ is suggested for polishing secondary effluents or dilute aqueous solutions to remove phosphate. (Schulz-FIRL)

W77-12421

SELECTIVE RENOVATION OF EUTROPHIC WASTES PHOSPHATE/SULPHATE EXCHANGE.

Istituto di Ricerche sulle Acque, Bari (Italy).
L. Liberti, G. Boari, and R. Passino.
Water Research, Vol 11, No 6, p 517-523, 1977. 8 fig, 3 tab, 7 ref.

Descriptors: *Phosphates, *Sulfates, *Chlorides, *Resins, *Ion exchange, Absorption, Sodium chloride, Separation techniques, Nutrient removal, Anion exchange, Equilibrium, Sewage treatment, *Waste water treatment. Identifiers: Anion exchange resins.

Equilibrium data on the sulfate-phosphate exchange in the sulfate-phosphate-chloride ternary system are presented. Selective ion exchange, using anion resins regenerated by sodium chloride, was evaluated for the removal of phosphate derivatives from conventionally treated sewage effluents. Physical-chemical characteristics for the 50 anion resins evaluated in this study are presented. Equilibrium isotherms which represent the equilibrium molar fractions of phosphate in the resin and in the solution are presented for the various resins tested. Four classes of anion resins were differentiated on the basis of selectivity. In general, the selectivity for phosphates was greater than for sulfates and the selectivity for sulfates was much greater than for chlorides. Variations in resin selectivities were attributed to electrostatic interactions in the chloride-sulfate and phosphate-sulfate exchanges, and to water content phenomena in the chloride-phosphate exchange. A resin of the binary amino type functional group (a commercial, weak base resin) is suggested for use with treated sewage effluent. The resin would generally be a crosslinked polyacrylic matrix based on a diethylenetriamine copolymer. Laboratory column experiments indicated that the use of a sodium chloride regenerant may allow the selective recovery of nutrients, such as phosphorus, from treated sewage effluents. (Schulz-FIRL)

W77-12422

PILOT-PLANT EXPERIMENTS ON SEWAGE PURIFICATION IN AN ACTIVATED SLUDGE SYSTEM WITH A SELECTOR (POLOPROVOZNI POKUSY S CISTENIM MESTSKE ODPADNI VODY V AKTIVACNIM SYSTEMU SE SELEKTOREM).

J. Chudoba, P. Grau, E. Sazovska, F. Bitner, and K. Hartig.
Technologie Vody, Vol F, No 29, p 161-211, 1976. 24 fig, 11 tab, 18 ref.

Descriptors: *Activated sludge, *Model studies, *Pilot plants, *Sewage treatment, Biological treatment, Biochemical oxygen demand, Chemical oxygen demand, Microorganisms, *Waste water treatment. Identifiers: Olomouc (Czechoslovakia).

Pilot studies in Olomouc, Czechoslovakia, on waste water treatment with activated sludge treatment are described. Two systems were used, including a model based on complete mixing and a selector system model incorporating two alternatives (with and without sludge regeneration). Mean and range values of BOD and COD in settled sewage were reported as 260 (+ or - 56) mg/liter and 434 (+ or - 97) mg/liter, respectively. The use of the complete mixing was ruled out for Olomouc sewage because of high sludge volume indices (300-1000 ml/g) caused by the growth of filamentous organisms during the process. Use of the selector system resulted in sludge volume indices of 150 to 350 ml/g which were further reduced to 100 ml/g with the addition of sludge regeneration. Operational parameters and physical and chemical characteristics for selector sludge were reported as follows: detention period 1 hour; regeneration period 2-3 hours; organic loading 2-4 kg BPD/cu m-d; sludge loading 0.3-1.0 kg BOD/kg MLSS-d; and BOD removals 84-99%. The selector activated sludge system is recommended over the completely mixed activated sludge system to reduce filamentous bulking during treatment. (Schulz-FIRL)

W77-12423

JAPANESE PHYSICO-CHEMICAL SYSTEM.

Water and Waste Treatment, Vol 20, No 6, p 13, June, 1977.

Descriptors: *Chemical degradation, *Activated sludge, *Sewage treatment, *Sewerage, *Treatment facilities, Biological treatment, Flocculation, Activated carbon, Settling basins, Costs, *Waste water treatment. Identifiers: *Physico-chemical treatment, Japan.

A physico-chemical sewage treatment (PCT) system, manufactured by Nippon Kokan in Japan, has been approved by Japan's Ministry of Construction. The system is designed for processing 200, 400 or 600 cu m of municipal sewage per day. Use of the PCT system instead of activated sludge treatment is reported to be advantageous when facilities are subject to large fluctuations in influent or slowdown of microbial action during periods of cold weather. With the PCT system, treatment begins when the amount of sewage in a storage well reaches a certain level. Treatment processes include activated carbon absorption, coagulation, flocculation and settling, and contact chlorination. After treatment the effluent passes through an up-flow filter before it is discharged with biochemical and chemical oxygen demands of less than 10 ppm. Estimated construction costs for the PCT system are projected at about two-thirds of costs for a comparable activated sludge system. (Schulz-FIRL)

W77-12424

PLANNING, EXECUTING AND PROFITING FROM POLYMER TRIALS.

Calgon Corp., Pittsburgh, Pa.
J. P. Hauck.
Water and Sewage Works, Vol 124, No 8, p 32-34, August, 1977.

Descriptors: *Polymers, *Dewatering, Planning, *Evaluation, *Polyelectrolytes, Organic compounds, On-site investigations, Pilot plants, Sludge treatment, Clarification, Municipal wastes, Operation and maintenance, *Waste water treatment.

Synthetic organic polyelectrolytes or polymers are used in municipal and industrial waste treatment for clarification and sludge dewatering. Procedures and objectives for polymer use planning and evaluation are presented. Polymer evaluation may be initiated to improve production, improve solids concentrations in dewatered sludge, reduce costs, reduce filtrate or centrate solids, or evaluate polymer performance for municipal bid requirements. After the objective is defined, mechanical or operating constraints must be examined, including incinerator capacity, sludge pump capacity, filtrate pump capacity, and plant design and maintenance. Laboratory studies should be conducted to select a polymer which will produce optimum results at a practical cost and to determine the relative consumption and performance which can be expected at the particular facility. Full-scale trials should be conducted at the plant to verify laboratory predictions. The optimal polymer addition point, operational constraints, and sampling and feed equipment requirements should be examined during this phase of the evaluation. Polymer choice is finalized at a meeting between plant personnel and the polymer supplier to examine laboratory and plant trial results. (Schulz-FIRL)

W77-12425

EFFECT OF RESIDENCE TIME ON FIXED FILM REACTOR PERFORMANCE.

Southern Illinois Univ., at Carbondale.
E. E. Cook, and S. M. Katzberger.
Journal Water Pollution Control Federation, Vol 49, No 8, p 1889-1895, August, 1977. 4 fig, 20 ref.

Descriptors: *Trickling filters, *Filtration, *Chemical oxygen demand, *Organic loading, Flow rates, Flow characteristics, Design criteria, Biological treatment, *Waste water treatment. Identifiers: Fixed film reactors, Rotating biological beds.

The effect of liquid residence time on organic removal efficiency by trickling filters was evaluated with a fixed film, rotating bed, biological reactor. Synthetic waste water was introduced to the reactor at flow rates of 25, 50, and 100 ml/min, corresponding to low, intermediate, and high rate hydraulic loadings used in conventional trickling filters. COD concentrations in the prepared waste water were 220, 440, and 880 mg/liter. The rotational speed of the reactor was set at 150 rpm and the inclination angles at 4, 10, 15, and 20 degrees from the horizontal since initial experiments indicated that the inclination angle had a greater effect on residence time than rotational speed. Tracer studies with NaCl were used to determine the effects of inclination angle, flow rate, and feed concentration on liquid residence time. Steady state conditions were established after 40 days with an inclination angle of 4 degrees when the reactor was seeded with microorganisms and loaded at 220 mg/liter COD and 25 ml/min. When flow rate or inclination angle was increased, liquid residence time decreased. Decreases in COD removal caused by decreased liquid residence time were greatest at high flow rates (100 ml/min) but were not significant at lower flow rates. Increased residence times at higher feed concentrations were attributed to increased biomass. Liquid residence time is suggested as a parameter in trickling filtration when COD feed concentrations and flow rates are high. (Schulz-FIRL)

W77-12427

ACTUATORS FOR EDINBURGH'S NEW SEWAGE DISPOSAL SCHEME.

Water Services, Vol 81, No 977, p 404, July, 1977.

Descriptors: *Electrical equipment, *Automatic control, *Monitoring, *Sewage treatment, Treatment facilities, Valves, Hydraulic valves, Equipment, Penstocks, Waste water treatment.
Identifiers: Seafield (Edinburgh Scotland).

Electric valve starters produced by Rotork Controls Limited (Lower Weston, Bath, Avon, United Kingdom) are being used for automatic monitoring and control at the Seafield sewage treatment plant in Edinburgh, Scotland. The Rotork 1400 series starter is used to control penstocks which regulate flow into and through the treatment works. Phase discriminators protect valves and penstocks from accidental damage caused by incorrect phase rotation or a dead phase. Echoes produced by sound waves are used to measure levels of sewage, sludge, or groundwater in tanks, channels, and pumps. A centralized control room receives information from level sensors and activates the Rotork system. The plant operation may be manually controlled, overriding the automatic system if necessary. (Schulz-FIRL)

W77-12429

WASTE SEGREGATION AS A MEANS OF ENHANCING ONSITE WASTEWATER MANAGEMENT,

Wisconsin Univ.-Madison. Small Scale Waste Management Project.
R. Siegrist.
Journal of Environmental Health, Vol. 40, No. 1, p 5-9, July-August, 1977. 1 fig, 4 tab, 16 ref.

Descriptors: *Domestic wastes, *Septic tanks, *Domestic water, *Laundering, *Separation techniques, Sewage treatment, Microorganisms, Coliforms, Soil disposal fields, Cesspools, Sewage bacteria, Sewage treatment, Sewage disposal, Waste water treatment.
Identifiers: Toilets, Black water, Gray water.

Segregation of household wastes by use into black water (toilet wastes) and gray water (other household wastes) is suggested to enhance on-site or septic tank waste water treatment. Chemical/physical and biological characteristics of household waste water are described. Surveys indicated that levels of indicator bacteria (coliforms) can be very high in household septic tank effluent, and that pathogenic organisms (*Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Salmonella*) can be present. The characteristics of separate gray and black water waste streams can, however, be very different. Gray water contributes most of the BOD, phosphorus, and flow to the household waste stream, at 63%, 70%, and 65% of the total, respectively. Black water contributes most of the suspended solids and nitrogen, at 61% and 82%. Indicator organisms and other bacteria are largely contributed by black water, but some proportion may enter the household waste stream from bath and laundry waste water. Black water treatment methods include non-water carriage toilets (composting, incinerating, and recycling systems) and low-volume flush toilets with provisions for off-site land disposal. Gray water disposal alternatives include the use of reduced-area soil absorption systems and sand filter systems. (Schulz-FIRL)

W77-12430

ADVANCED SEWAGE TREATMENT FAILS COST-ENVIRONMENTAL BENEFIT TEST.

For primary bibliographic entry see Field 5G.

W77-12431

WATER POLLUTION ABATEMENT PROGRAM SERVES INDEPENDENCE, MISSOURI,

Burns and McDonnell, Kansas City, Mo.
J. E. White.

Water and Sewage Works, Vol. 124, No. 8, p 50-51, August, 1977.

Descriptors: *Interceptor sewers, *Treatment facilities, *Sewage treatment, *Pumping plants, Construction, Sewerage, Clarification, Activated sludge, Sewage disposal, Sludge disposal, *Waste water treatment, Sludge treatment.
Identifiers: Independence(MO), Rock Creek(MO), Sugar Creek(MO).

The Rock Creek and Sugar Creek Watersheds project was initiated to provide new interceptors, two raw waste water pump stations, peak flow detention facilities, and a secondary waste water treatment facility for the city of Independence, Missouri. Replacement of the existing interceptor sewer system involved the construction of approximately 37,500 ft of interceptors ranging in size from 12 to 54 inches in diameter. The Rock Creek pumping station is designed to handle a total waste flow of 60 mgd with separate pumping systems for wet weather peak flow and for waste water treatment. The Sugar Creek Watershed pump station is designed to handle 6.5 mgd. The 7.5 mgd waste treatment plant at Rock Creek includes four primary clarifiers, a primary thickening basin, four activated sludge basins, four secondary clarifiers, and two dissolved air flotation basins. Chlorine contact basins disinfect effluent before it is discharged to the Missouri River. Heat treatment, dewatering, and incineration are used for sludge disposal. (Schulz-FIRL)

W77-12432

CONTROL FUNCTIONS AT COPPERMILLS WORKS.

Water Services, Vol. 81, No. 977, p 407, 409, July, 1977.

Descriptors: *Automatic control, *Filters, *Treatment facilities, *Hydraulic valves, *Hydraulic systems, Butterfly valves, Flow control, Hydraulic equipment, Pumps, Pumping plants, Electrical equipment, *Waste water treatment.
Identifiers: Coppermills(UK), London.

Operation and automatic control of the Coppermills treatment works in London, England, are described. The filtration plant includes automatic aeration and washing sequences for the 24 filter beds. The hydraulic system which services the filters includes power equipment, filter bed control equipment, and filter valve starting equipment. Two power cabinet assemblies provide hydraulic power to the beds, each of which contains 4 motor pump units; 2 units for inlet, washout, upwash, and air valves; and 2 units for outlet valves. Each power cabinet assembly provides power for a bank of 12 of the 24 beds but can power the entire set of 24 beds in an emergency situation. Remote electrical control is used to regulate opening and closing of valves. A 610 mm square inlet penstock, a 915 mm square wash-out penstock, and the outlet butterfly valve are operated by linear starters. Upwash and air butterfly valves are operated by mounted semi-rotary valve starters. A Lockheed Hydraulic System controls the butterfly valves for the 16 pumps within the pumping station by means of double-acting hydraulic cylinders and four-way control valves. Portable manually-operated power packs provide emergency power for valve starters. (Schulz-FIRL)

W77-12433

REMOVAL OF NITRATE FROM EFFLUENT FOLLOWING DISCHARGE ON SURFACE WATER,

Ministerie van Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
J. F. van Kessel.
Water Research, Vol. 11, No. 6, p 533-537, 1977. 4 fig, 2 tab, 16 ref.

Descriptors: *Soil chemical properties, *Denitrification, *Nitrates, *Sediment-water interfaces, *Waste assimilative capacity, Eutrophication, Water pollution control, Model studies, Bacteria, Nitrogen, *Waste water treatment.

Identifiers: Goor(Netherlands).

The removal of nitrate from surface waters by denitrification in sediments was examined in field and laboratory experiments with secondary-treated effluent from a waste water treatment plant at Goor in the Netherlands. In field experiments, treated waste water was discharged from the plant into a canal whose depth was maintained at 1.3 m by an adjusted weir. Effluent samples were taken prior to discharge and along the canal at three stations (200 m above the discharge point, and 30 m and 830 m below the discharge point). Chloride, nitrate, nitrite, ammonia, water and sediment temperatures, and dissolved oxygen levels were measured throughout the study. For laboratory experiments, three undisturbed water-sediment columns were collected below the discharge point. Average nitrate-nitrogen concentrations for samples collected 30 m and 830 m below the discharge point were 0.14 and 0.33 mg/liter, respectively. For the 800-m length of canal with an estimated sediment surface area of 6240 sq m, the average rate of nitrate-nitrogen removal during the 19-day study period was 913 mg nitrate-nitrogen/sq m/day. Laboratory studies with water-sediment columns showed that nitrate-nitrogen removal from overlying water increased with incubation time. Denitrification in sediments is suggested as a possible solution to nitrogen-induced eutrophication of surface waters. (Schulz-FIRL)

W77-12435

BAY-AREA INDUSTRIES TO RE-USE TREATED WASTEWATER.

Civil Engineering, Vol. 47, No. 8, p 76-77, August, 1977. 1 fig, 1 tab.

Descriptors: *Water reuse, *Treatment facilities, *Filtration, *Flocculation, *Sewage treatment, Municipal wastes, Lime, Denitrification, Nitrification, Effluents, Waste water treatment.
Identifiers: San Francisco Bay.

Central Contra Costa Sanitary District's 30-mgd waste water recycling plant at Pacheco on Suisun Bay in California will provide 17 mgd of treated waste water for five San Francisco Bay-area industries (Phillips Petroleum, Shell Oil, Stauffer Chemical, Monsanto, and Pacific Gas and Electric). Physical-chemical treatment is necessary because water reused by the area industries must be low in phosphorus, BOD, and suspended solids. Lime and ferric chloride introduced at the primary stage at a 1.5 mgd test facility removed 91% of the phosphorus, 75% of the BOD, 91% of suspended solids, 94% of the grease, and virtually all of the heavy metals. Treatment at the facility includes flocculation, sedimentation, oxidation and nitrification, chlorination, denitrification, and dual media filtration. Waste water effluent which is not reused by industry is discharged to Suisun Bay. A computer control system is used to operate and monitor the facility. Pyrolysis will ultimately replace existing multiple hearth incinerators for sludge disposal with refuse-derived fuel provided by a combination of combustible municipal refuse and sludge. (Schulz-FIRL)

W77-12437

DESIGN OF SEWAGE OXIDATION PONDS FOR AUSTRALIAN CLIMATIC CONDITIONS,

New South Wales Univ., Kensington (Australia).
School of Civil Engineering.
P. J. Bliss.

The Institution of Engineers, Australia, Vol. CE 18, No. 2, p 69-73, 1976. 4 fig, 9 ref.

Descriptors: *Oxidation lagoons, *Design criteria, *Australia, *Climatology, *Biochemical oxygen demand, Aerobic treatment, Kinetics, Mathematical models, Organic loading, Temperature, *Waste water treatment.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

A method for designing the first in a series of oxidation ponds which consider climatic conditions, temperatures, pond area and depth, and influent BOD is presented. Oxidation pond design methods include empirical design factors, the Hermann and Gloyna method, and a kinetic-based design method. For empirical design, average liquid detention time is calculated on the basis of BOD loading, influent BOD concentration, and pond depth. The Hermann and Gloyna method is based on short-term studies of pilot-scale pond performance with corrections for pond water temperature and waste BOD. Oxidation pond design based on pond kinetics assumes that organic matter degradation is a first-order reaction, that the pond is a completely mixed system, and that evaporation and infiltration losses are small. Total mass of influent BOD is related to mass of effluent BOD and the mass of BOD removed in the reactor, which is the product of pond volume, permissible pond liquid BOD, and a reaction rate constant. The simplified design procedure presented here relates an area factor adjusted for maximum daily temperatures during coldest and warmest months, pond depth, and influent BOD levels. It is suggested that second and subsequent oxidation be designed according to the required reduction in indicator organisms. Temperature adjustments and the geographic distribution of adjustment factors are illustrated for Australia. (Schulz-FIRL) W77-12438

IMPELLER DESIGN KEEPS DOWN PUMP SET MAINTENANCE.

For primary bibliographic entry see Field 8C. W77-12439

SINGLE-HEARTH SCREENINGS INCINERATOR.

For primary bibliographic entry see Field 5E. W77-12440

POLLUTION CONTROL BY INCINERATION.

For primary bibliographic entry see Field 5E. W77-12441

GAS TURBINE GEN-SETS FOR SEWAGE TREATMENT STANDBY.

Diesel and Gas Turbine Progress, Vol. XLIII, No. 8, p 56-57, August, 1977.

Descriptors: *Turbines, *Generators, *Electric power, Equipment, *Hydraulic turbines, Design data, Power operation and maintenance, Electric power production, Electric power failure, Waste water treatment.

Identifiers: *Gas turbine generators, West Babylon(NY).

A dual drive, 3300 kW (continuous), Allison gas turbine generator set using the 501 KA engine is being provided for a waste water treatment plant in West Babylon, New York by the Western Engine Company of Addison, Illinois. The turbine generator will be used at the 30 mgd plant to power a 1725 hp blower for aeration, as well as various lift stations. It will also provide emergency power in case of a utility power failure. The generator set contains two gas turbine engines operating at 13,780 rpm and is started by a hydraulic high pressure pump within 36 seconds. Additional design and operating standards for the turbine set are presented. (Schulz-FIRL) W77-12442

DECEPTIVE HORSE BARN.

Consulting Engineer, Vol. 49, No. 2, p 112, 114, August, 1977.

Descriptors: *Treatment facilities, *Biological treatment, *Sludge disposal, *Sewage treatment, Recreation facilities, Fertilizer, Sewage treatment, Aerobic treatment, *Waste water treatment.

A sewage treatment facility has been designed to treat from 25,000 to 150,000 gallons of waste water from raw sewage generated at Kentucky Horse Park. The park's sewage treatment plant, housed in two barn-like structures, will also supply fertilizer and irrigation water for the park's 23 acres of pasture land. Waterproof gravity-flow sewer lines are used to collect waste water. The facility includes three concrete lagoons and an aerobic secondary biological treatment process system manufactured by Autotrol of Milwaukee, Wisconsin. The project, which treats wastes from the park's one to two million annual visitors, was designed and engineered by Central Associated Engineers, Versailles, Kentucky. (Schulz-FIRL) W77-12443

COTTONVALLEY--THE ATTRACTIVE SEWAGE WORKS.

J. Pullin. Surveyor, Vol. 150, No. 443, p 9, May-July, 1977.

Descriptors: *Treatment facilities, *Sewage treatment, *Tertiary treatment, *Settling basins, Municipal wastes, Incineration, Sludge disposal, Sludge treatment, Waste water treatment.

Identifiers: Cottonvalley(UK), Milton Keynes(UK), United Kingdom.

The Cottonvalley sewage treatment facility at Milton Keynes, United Kingdom, is described. Commissioned by the Anglian Water Authority, the treatment plant was designed to relieve overloading of works at Bletchley and Wolverton. The facilities include automatic screen raking, Archimedean screw pumps, four primary settling tanks, four aeration tanks, and eight secondary settling tanks. Tertiary treatment will be provided by eight high-rate sand filters. Incineration will be the primary means of sludge disposal. The plant capacity will initially be designed for a population of 117,000 with later modification to increase the capacity to a population of 275,000. (Schulz-FIRL) W77-12446

CONVEYOR SYSTEM MOVES SEWAGE QUICKLY, PREVENTS SPILLAGE.

For primary bibliographic entry see Field 8G. W77-12447

TREATMENT IN THE SEWER CUTS THE WORKS' LOAD.

J. Pullin. Surveyor, Vol. 150, No. 4440, p 21-22, 27, July, 1977.

Descriptors: *Sewers, *Sewage treatment, *Dissolved oxygen, *Aeration, *Anaerobic conditions, Anaerobic digestion, Sulfides, Biochemical oxygen demand, Suspended solids, Treatment facilities, Sewerage, Settling basins, *Waste water treatment.

Identifiers: Hydrogen peroxide, Oxygen injection systems, Sewage pretreatment.

In-sewer treatment with the addition of oxygen or air to anaerobic sewage has been used to curb sewage septicity, prevent build-up of sulfides, and extend treatment plant capacities. Compressed air or oxygen can be added to a rising main discharging to the works or to a pressure main that has a continuous upward slope. Dissolved oxygen levels in sewage can also be increased by the addition of hydrogen peroxide which gradually decomposes to yield water and oxygen. Approximately 50 treatment facilities in the United Kingdom currently use dissolved oxygen injection in rising mains to prevent sulfide build-up. The Water Research Center investigated anaerobic conditions in gravity sewers and found that aeration caused by turbulent flow was responsible for oxidizing up to 20 percent of organic impurities in sewage, and that anaerobic digestion partially treats sewage if dissolved oxygen levels are insufficient for aerobic processes. The addition of dissolved oxygen is

also reported to increase settling basin performance. A pilot study by the Wessex Water Authority indicated that the use of an oxygen injection system can reduce BOD and suspended solid loads by approximately 50 percent, sludge volume by 10 percent, and pump power requirements by about 8 percent, as well as eliminate filamentous *Leucothrix* bacteria from sewage. (Schulz-FIRL) W77-12448

SEWER RENOVATION TECHNIQUES.

For primary bibliographic entry see Field 8C. W77-12449

THE CONSTRUCTION OF THE FIRST PHASE OF THE MODERNISATION OF SHIELDHALL SEWAGE WORKS IN GLASGOW.

Fairhurst (W. A.) and Partners, Glasgow (Scotland). J. T. Motion.

Chartered Municipal Engineer, Vol. 104, No. 7, p 121-127, July, 1977. 5 fig.

Descriptors: *Treatment facilities, *Construction, *Construction materials, *Sewerage, *Settling basins, Construction costs, Engineering structures, Concrete technology, Sewage treatment, Biological treatment, Municipal wastes, Design data, Structural engineering, Waste water treatment.

Identifiers: Shieldhall, Glasgow, Scotland.

Plans for expansion by Fairclough Ltd. of the Shieldhall sewage treatment plant in Glasgow, Scotland, to provide biological treatment of up to 144 mgd of municipal and industrial wastes are described. The first phase of the two-part project is based on treatment needs of a design dry weather flow of 48 mgd with reserved space for future expansion. Construction details for the sewage collection system are presented. Sulfate-resistant cement externally coated with bitumastic plastic was used in sewer pipes to prevent corrosion by the area's acidic soils. A low level pumping station is used to transport wastes for an interceptor sewer to the pre-sedimentation works. The pre-sedimentation works include an entry channel, screening bays, six trapezoidal grit channels, and associated penstocks to the six screw pumps. Six screw pumps lift the sewage to permit gravity flow to the primary sedimentation tanks and the rest of the treatment facility. Construction details for the sludge pump house, sludge holding tanks, and tanker bay which follow the primary sedimentation tanks are provided. Storm tanks are being constructed to accommodate flows entering the system in excess of presedimentation works capacity. The design of the storm tanks is analogous to that of the primary tanks except the storm tanks are constructed below the water table. Outfall works will be used at Shieldhall until biological treatment facilities are completed in the second phase of the project. (Schulz-FIRL) W77-12450

WASTE WATER TREATMENT SYSTEM.

Chemical Engineering, Vol. 84, No. 16, p 44, August, 1977.

Descriptors: *Activated sludge, *Suspended solids, *Industrial wastes, *Municipal wastes, *Equipment, Biochemical oxygen demand, Aeration, Clarification, Sludge treatment, Treatment facilities, *Waste water treatment.

A waste water treatment system for the processing of more than 10 mgd of industrial or municipal waste is being marketed by the Mixing Equipment Corporation in Rochester, New York. The system is reported to reduce BOD and suspended solids satisfactorily in the activated sludge process using sludge with initial suspended solids concentrations of up to 3000 mg/liter. Other aspects of the system include mechanical aerators for oxygenation of

waste water, integral clarifiers for surface and settled sludge removal, and a large aeration basin. Operating conditions for the system are placed at mixed-liquor suspended-solids concentrations of 3,000 mg/liter. (Schulz-FIRL)
W77-12451

WANTED: BETTER WAYS TO CLEAN WATER.
Environmental Science and Technology, Vol. 11, No. 8, p 748-749, August, 1977. 1 fig.

Descriptors: *Organic wastes, *Ozone, *Activated carbon, *Resins, *Electrolysis, Water management (Applied), Groundwater, Disinfection, Effluents, Industrial wastes, Municipal wastes, *Waste water treatment, *Water treatment.

Highlights of the Second Joint Conference of the Chemical Institute of Canada and the American Chemical Society in Montreal are discussed. Suggested methods for the removal of toxic organics in water or waste water treatment include the use of granular activated carbon and synthetic resins. Discussions on the application of ozone for disinfection and for removal of color, odor, and bad taste are described. Electrolysis with NaCl as the electrolyte is considered. The use of closed waste treatment systems to solve effluent problems, the need for groundwater protection, and the levying of pollution fines were also considered. (Schulz-FIRL)
W77-12452

AQUEOUS EFFLUENT PURIFICATION BY MICROBIAL FERMENTATION-FEEDING BIOMASS TO PROTOZOA TO FORM BIOMASS AS PROTEIN SOURCE.
Belgian Patent BE-849-148. Issued June 7, 1977. Derwent Belgian Patents Abstracts, Vol. Y, No. 24, p D1, July, 1977.

Descriptors: Microorganisms, *Food chains, *Biodegradation, *Protozoa, *Patents, Nutrients, Proteins, *Fermentation, Cultures, Sludge treatment, *Sewage treatment, *Waste water treatment.
Identifiers: Pseudomonas, Brevibacterium, Torula yeasts, Tetrahymena pyriformis, Colpidium campylophorum.

A biological process for the treatment of waste water which contains biodegradable organic materials is described. Organic wastes are used as a culture medium for the exponential growth of microorganisms. The waste is cultured until it provides a suitable medium for microorganism-consuming protozoans. The protozoal biomass can then be removed from the waste water and used as a protein source for livestock feeds. Suggested microorganisms include aerobic bacteria and/or yeasts (specifically, Pseudomonas and Brevibacterium) and Torula yeasts. Ciliated protozoa are suggested for microorganism consumption, including Tetrahymena pyriformis and Colpidium campylophorum. (Schulz-FIRL)
W77-12453

OXYGEN ADDITION REGULATION IN WATER AND SEWAGE PURIFICATION - USING EJECTORS TO SECURE INTIMATE CONTACT WITH ACTIVATED SLUDGE.
French Patent FR 2320-908. Issued April 15, 1977. Derwent French Patents Abstracts, Vol. Y, No. 21, p D2, July, 1977.

Descriptors: *Activated sludge, *Patents, *Aeration, *Oxygenation, *Aerobic conditions, Biodegradation, Organic wastes, Oxygen requirements, Sewage treatment, *Waste water treatment.

A method of activated sludge oxygenation for use in facilities with cascade-mounted units has been patented. Waste water is agitated with gas contain-

ing at least 20-45 volume percent of oxygen. Water is fed to two units from an inlet in the suction side of a recycling pump. The activated sludge mixture is pumped through an oxygen injector with recycled gas furnished by a compressor. Settled sludge is transported to the first unit in the cascade and goes into suspension. The quantity of oxygen furnished to the first unit is dependent upon the amount of biodegradable material present and upon the amount of oxygenation necessary to maintain an oxygen concentration of 0.25 mg/liter. Oxygen concentrations are measured with a probe. Oxygen is rapidly transferred to the finely-divided activated sludge. (Schulz-FIRL)
W77-12454

ELIMINATION OF NITROGEN COMPOUNDS FROM WASTE WATER - BY DOWNWARDS PASSAGE THROUGH BIOLOGICAL TREATMENT UNITS IN A SUITABLE ATMOSPHERE.
Netherlands Patent NL 7613-165. Issued May 31, 1977. Derwent Netherlands Patents Report, Vol. Y, No. 24, p D6, July, 1977.

Descriptors: *Biological treatment, *Nitrogen compounds, *Denitrification, *Patents, *Ammonia, Nitrates, Nitrites, Ammonium compounds, Reduction (Chemical), Bacteria, Nitrogen, *Waste water treatment.

A process for the biological removal of nitrogen compounds, nitrates, nitrites, and ammonia compounds has been patented. Waste water is conducted through a distribution chamber and a series of recipients for the biological reduction of nitrates and oxygen removal. The waste water then flows into a gas distribution chamber, where a nitrogen atmosphere is produced by the introduction of gas which flows in a direction counter-current to the waste water stream. The series of superimposed recipients is fitted with interconnecting overflow tubes. The lower portion of the recipients is filled with nutrient-treated, inoculated porous bodies which denitrify bacteria. The biological treatment process is reported to eliminate dissolved nitrogen compounds in a few minutes at costs much lower than those for chemical treatment processes. (Schulz-FIRL)
W77-12455

WASTE WATER AERATING AND CLARIFYING TANK-HAS PERFORATED PLATE FOR CIRCULATION BETWEEN AERATION AND CLARIFICATION ZONES.
Soviet Patent SU-387-935. Issued November 14, 1973. Soviet Inventions Illustrated, Vol. Y, No. 26, p D1, August, 1977.

Descriptors: *Activated sludge, *Aeration, *Oxidation, *Patents, Sludge treatment, Design data, Organic wastes, *Waste water treatment.

Design data for a patented aerating and clarifying basin are presented. The waste water treatment tank contains a casing equipped with a water removal channel; a water supply pipe; aerators, and partitions separating the aeration, clarification, and pulse-damping zones. The partitions, composed of perforated plates, extend horizontally over the clarification zone to stabilize the fluidized bed and to intensify recirculation between the aeration and clarification zones. Vertical sloping partitions divide the tank into a central compartment for aeration and two lateral compartments of the flatbottomed tank and is treated with activated sludge from the clarification zone. Intense mixing in the aeration zone results in accelerated oxidation of organic impurities. (Schulz-FIRL)
W77-12456

REMOVAL OF SLUDGE FROM WASTE WATER TREATMENT PLANT-BY ROTARY

SWEEP FOOTBRIDGE WITH INBUILT SUCTION SCRAPER.
French Patent FR 2320-909. Issued April 15, 1977. Derwent French Patents Abstracts, Vol. Y, No. 21, p D2, July, 1977.

Descriptors: *Settling basins, *Patents, *Equipment, *Sludge treatment, Sludge disposal, Hydraulic transportation, Separation techniques, Dewatering, Pumping, Waste water treatment. Identifiers: Footbridges, Sludge transport.

A rotary sweep footbridge, which is bearing-mounted on one end and carried on rollers around a circumferential track at the other end, has been patented as a device for the removal of sludge from a waste water treatment plant. The bridge is a trapezoidal-section channel with a walkway across the larger, upper face. An electric collection rotor and a suction outlet pipe are coaxial with the central bearing. A metal service pit for the sludge suction manifold system, a sludge scraper, and suction pipes are carried by the beam. The footbridge assembly, used to remove settled sludge from settling basins, is capable of directly pumping sludge from the basin without additional storage or transport. (Schulz-FIRL)
W77-12457

TREATMENT OF AQUEOUS WASTE STREAMS.
Australian Patent 483,271. Issued May 26, 1977. The Australian Official Journal of Patents, Trade Marks, and Designs, Vol. 47, No. 18, p 1654, May, 1977.

Descriptors: *Chemical wastes, *Patents, *Chlorination, *Organic compounds, Chemical reactions, Chemical precipitation, *Waste water treatment. Identifiers: Chlorinated isocyanurates.

A process for removing chlorinated isocyanurates from waste water has been patented. Aqueous waste water at a pH of from 0.5 to 7.0 is treated with hydrogen peroxide at a pH of from 0.5 to 12.0. The isocyanurates are thereby dechlorinated to form a precipitate of cyanurate, and evolved. The precipitate is then removed from the waste water stream. (Schulz-FIRL)
W77-12458

HEAVY RAINS, POOR SOIL FORCE INTERNAL SEWER REPAIR.
For primary bibliographic entry see Field 8F.
W77-12459

EPA SETS RULES ON 'INELIGIBLE' SEWERS.
For primary bibliographic entry see Field 5G.
W77-12460

EASING THE BURDEN ON TREATMENT WORKS.
For primary bibliographic entry see Field 5G.
W77-12461

SURGE ARRESTOR CONTROLS FLORIDA SEWAGE.
For primary bibliographic entry see Field 8C.
W77-12462

NORTH EAST SEWERAGE SCHEMES, PUMP CONTRACTS.
For primary bibliographic entry see Field 8C.
W77-12463

HOW TO CONDUCT A WASTEWATER SURVEY, PART I - IDENTIFYING PHYSICAL CHARACTERISTICS OF SEWER SYSTEMS.
Burns and Roe Industrial Services Corp., Paramus, N.J.
For primary bibliographic entry see Field 5G.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

W77-12465

SCIENTIFIC AND TECHNICAL EVALUATION OF THE ENVIRONMENTAL PROTECTION AGENCY'S WASTEWATER FACILITIES PLANNING, BOSTON CASE STUDY, PHASE I: WATER QUALITY CONSIDERATIONS, Resource Analysis Inc., Cambridge, Mass. For primary bibliographic entry see Field 5G. W77-12472

EVALUATION OF FLOW EQUALIZATION AT A SMALL WASTEWATER TREATMENT PLANT,

Johnson and Anderson, Inc., Pontiac, Mich. G. W. Foess, J. G. Meenahan, and J. M. Harju. Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 375. Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-76-181, September 1976. 47 p, 11 fig, 11 tab, 12 ref.

Descriptors: *Diurnal distribution, *Equalizing reservoirs, Hydraulic structures, *Biochemical oxygen demand, *Suspended solids, Pilot plants, Model studies, Flow control, Load distribution, Sewage treatment, Phosphorus, *Waste water treatment, *Treatment facilities.
Identifiers: Flow equalization.

A twelve-month study of a flow equalization system at the Walled Lake/Novi waste water treatment plant in Novi, Michigan is described. At the Novi plant, activated sludge treatment and multimedia tertiary filters are used to treat domestic waste flows of 0.092 cu m/sec (2.1 mgd). Designs of the plant and its equalization basin are presented. Process streams under equalized flow conditions were monitored throughout the study for BOD, total suspended solids, and total phosphorus. Final settling and filtration efficiencies were examined with and without flow equalization. The flow equalization basin at Novi includes a 355,000 gal basin equipped with a diffused air mixing system and a sludge scraping mechanism. Results of the study indicated that the flow equalization basin was highly effective at leveling influent flow variations but was not appreciably effective at evening out concentrations of waste water constituents. During settling, BOD removal was greater under non-equalized flow conditions while total suspended solids removal was greater under non-equalized flow conditions. Removal of both constituents during filtration was greater during equalized flow than under diurnal flow conditions. Flow equalization is recommended for use upstream from granular media filters. (Schulz-FIRL) W77-12473

CONVENTIONAL TERTIARY TREATMENT, District of Columbia Dept. of Environmental Services, Washington, EPA-DC Pilot Plant. T. P. O'Farrell, and D. F. Bishop.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 522. Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-76-251, November 1976. 30 p, 5 fig, 8 tab, 17 ref.

Descriptors: *Tertiary treatment, *Clarification, *Phosphorus, *Activated carbon, *Ammonia, Lime, Calcium compounds, Filtration, Pilot plants, Model studies, *Waste water treatment, Water reuse, District of Columbia.
Identifiers: Washington(DC).

Secondary effluent from the EPA-DC Pilot Plant in Washington was used in an evaluation of tertiary treatment with primary sedimentation, step aeration, two-stage or single-stage (lime-soda carbonate) high pH lime clarification, ammonia stripping, filtration, neutralization, and activated carbon adsorption. Studies indicated that two-stage lime clarification of secondary effluent with

suspended solids of less than 25 mg/liter was able to reduce phosphorus to 0.13 mg/liter and BOD to 2.1 mg/liter. Dual media filtration further reduced phosphorus to 0.09 mg/liter and BOD to 1.4 mg/liter. Carbon adsorption with fresh carbon reduced total organic carbon to less than 3 mg/liter. Nitrogen removal by ammonia stripping was not adequate for District of Columbia standards. Organic solids concentrations greater than 25 mg/liter produced by filamentous growths in the activated sludge system impeded clarifier performance. Recalcined lime was effectively recycled through the clarification system. Physical-chemical treatment for phosphate and carbon removal as evaluated in this study is recommended for the production of very high quality effluent and for waste water reuse. (Schulz-FIRL) W77-12474

HANOVER PARK TERTIARY STUDIES, Metropolitan Sanitary District of Greater Chicago, Chicago, Ill.

D. R. Zenz, E. Bogusch, C. Lue-Hing, and A. W. Obayashi. Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 596. Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-76-264, December 1976. 36 p, 7 fig, 7 tab, 2 ref, 1 append.

Descriptors: *Tertiary treatment, *Filtration, *Ion exchange, *Phosphorus, *Aluminum, Filters, Sewage treatment, Suspended solids, Porous media, Sodium compounds, Model studies, Operation and performance, *Waste water treatment.
Identifiers: Activated alumina, Deep-bed filters, Continuous ion-exchangers, Sodium hydroxide, DeLaval filters, Neptune Microfloc Unit, Graver filter, Dual-media filters, Mixed-media filters, Chicago(IL).

The Hanover Park water reclamation plant in Chicago was the site of a year-long evaluation of 4 tertiary treatment units. Three deep-bed filters were tested with secondary effluent, including: the DeLaval Filter (an upflow sand filter); the Neptune Microfloc Unit (a downflow mixed-media gravity filter containing anthracite, sand, and garnet); and the Graver Filter (a downflow dual-media pressure filter containing anthracite and sand). A continuous-flow ion exchanger that removed phosphate from micro-screened secondary effluent was the fourth unit tested. The filters were tested at flow rates of from 2 to 6 gpm/sq ft. Results indicated that at 4 gpm/sq ft all filtration units were capable of producing filtrates from secondary effluent with suspended solids and BOD of less than 10 mg/liter. The Neptune Filter yielded slightly better results than the Graver or DeLaval Filters. Activated alumina in the continuous ion-exchanger was capable of removing up to 87% of the total phosphorus from micro-screened secondary effluent. It was also demonstrated that 0.4N sodium hydroxide was effective at regenerating phosphate-exhausted alumina. Further investigations of phosphate removal by activated alumina and of tertiary filtration as means of producing high quality effluents are recommended. (Schulz-FIRL) W77-12475

HANDBOOK FOR SEWER SYSTEM EVALUATION AND REHABILITATION.

Environmental Protection Agency, Washington, D.C. Office of Water Program Operations. Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 457. Price codes: A11 in paper copy, A01 in microfiche. Technical Report EPA-430/9-75-021, December 1975. 228 p, 47 fig, 25 tab, 17 ref, 4 append.

Descriptors: *Infiltration, *Sewerage, *Pipes, *Inflow, *Sewers, *Evaluation, Analytical techniques, Model studies, Sewage treatment, Surveys, Rehabilitation, Costs, Waste water treatment.

Identifiers: *Sewer system evaluation, Sewer system rehabilitation, Infiltration/inflow analysis.

A manual to assist in the preparation and review of infiltration/inflow analyses and sewer system evaluation surveys is presented. Construction grant regulations imposed by the Federal Water Pollution Control Act Amendments of 1972 are discussed with respect to sewer system evaluation and rehabilitation. A user's guide to the handbook is presented. Methodology for conducting infiltration/inflow analysis, representative data, and work sheets are provided. Aspects of a sewer system evaluation survey are described, including a physical survey, rainfall simulation, preparatory cleaning, internal inspection, and the survey report. Excavation/replacement, chemical grouting, pipe lining with polyethylene pipe, pipe lining with fiberglass-reinforced polyester mortar pipe, and pipe lining with cement mortar and epoxy mortar are examined as methods of sewer rehabilitation. Representative costs for sewer system evaluation and rehabilitation are presented. (Schulz-FIRL) W77-12479

A SURVEY OF COMMERCIALLY AVAILABLE AUTOMATIC WASTEWATER SAMPLERS, Environmental Monitoring and Support Lab., Cincinnati, Ohio.

For primary bibliographic entry see Field 5A. W77-12481

BIOFLOCCULATION AND THE ACCUMULATION OF CHEMICALS BY FLOC-FORMING ORGANISMS,

Ohio State Univ., Columbus. Dept. of Microbiology. P. R. Dugan.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 793. Price codes: A08 in paper copy, A01 in microfiche. Report EPA-600/2-75-032, September 1975. 148 p, 51 fig, 21 tab, 119 ref.

Descriptors: *Flocculation, *Bacteria, *Polymers, *Coagulation, *Absorption, *Adsorption, Sewage treatment, Activated sludge, Organic compounds, Heavy metals, Colloids, Aquatic bacteria, Chemical wastes, Slime, *Waste water treatment.
Identifiers: *Bioflocculation, Zoogaea ramigera, Microbial polymers.

Major objectives of this study were to examine the process of flocculation and to investigate biological mechanisms associated with bio-flocculation, including the formation of the zoological matrix by floc-forming bacteria. Several species of floc-forming bacteria were isolated from limestone covered with zoogeal masses and effluents from organically polluted water. Isolated organisms were gram negative, polar flagellated rods which produced extracellular polymer fibrils. In studies with Zoogaea ramigera, polymer extracts were observed to concentrate heavy metals such as Co, Cu, Fe, and Ni; soluble organic nutrients (BOD); soluble toxic organics; insoluble mineral particles; and insoluble organic particulates. Commercial applications of extracellular polymer are suggested for physical adsorption, metabolic reduction, and oxidation of waste water pollutants. Bioflocculation is suggested as a natural mechanism of water purification. (Schulz-FIRL) W77-12482

NEW MICROBIAL INDICATORS OF DISINFECTION EFFICIENCY,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering. For primary bibliographic entry see Field 5A. W77-12483

MATHEMATICAL MODELING OF HETEROGENEOUS SORPTION IN MATHEMATICAL CONTACTORS FOR WASTEWATER

DECONTAMINATION: INFLUENCE OF REVERSIBILITY AND CHROMATOGRAPHIC EFFECTS ON SYSTEM DESIGN AND OPERATION.

Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
T. M. Keinath, H. Kares, S. Lowry, and M. S. Abdo.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A031 179. Price codes: A09 in paper copy, A01 in microfiche. Final Report, April 1976. 169 p, 69 fig, 5 tab, 55 ref. DADA-17-73-C-3154.

Descriptors: *Sorption, *Mathematical models, *Activated carbon, Chemical reactions, Separation techniques, Model studies, Equipment, *Treatment facilities, Evaluation, Kinetics, *Waste water treatment, *Design, *Operations. Identifiers: Longmuir Competitive Adsorption Model, Longmuir Semi-Competitive Ideal Solution Theory and Graphical Models.

A predictive mathematical model was developed to aid various studies of activated carbon adsorption. The major objective was to model multiple solute adsorption onto activated carbon from solution by a differential contacting system. Present multisolute adsorption equilibria models were evaluated. The influence of adsorption reversibility and chromatographic effects on the operation of prototype adsorbers was also determined. Bissolute combinations of o-phenylphenol (OPP), dinitro-o-sec-butylphenol (DNOSBP), and 2,4-dichlorophenol (2,4-DCP) were used in several adsorption equilibria studies. The Longmuir Competitive Adsorption Model and the Longmuir Semi-Competitive Ideal Solution Theory and Graphical Models were evaluated. Although neither method sufficiently described competitive adsorption effects, the graphical method produced the best estimates. Mathematical model simulations produced several observations. Fluidized bed operation minimized the elution of adsorbed contaminants from adsorbers much better than packed-bed operation. All contaminants of industrial production should be discharged simultaneously. Waste waters with the highest energy-adsorbing contaminants should be introduced first to a column of fresh adsorbent, with the lowest energy-adsorbing contaminants entered last. Minimization of displacement and subsequent elution of adsorbed contaminants resulted from using concentration equilibration before the adsorbers. These conclusions were generally supported by columnar laboratory studies. (Collins-FIRL)

W77-12484

WATER RENOVATION OF MUNICIPAL EFFLUENTS BY REVERSE OSMOSIS.

General Atomic Co., San Diego, Calif.

J. E. Cruver, J. E. Beckman, and E. Bevege.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-240 018. Price codes: A07 in paper copy, A01 in microfiche. Report EPA-670/2-75-009, March 1975. 122 p, 38 fig, 19 tab, 28 ref, 2 appendix.

Descriptors: *Reverse osmosis, *Separation techniques, *Activated carbon, *Membrane processes, *Tertiary treatment, Sewage treatment, Chemical reactions, Activated sludge, Filtration, Effluents, Costs, *Waste water treatment. Identifiers: *Spiral-wound modules.

Field experiments were performed to examine reverse osmosis for use in the treatment of municipal primary and secondary effluents with varying degrees of pretreatment. Effluents tested included primary effluent with and without sand filtration, sand-filtered activated sludge effluent, chemically clarified primary effluent with sand filtration, chemically clarified primary effluent with sand filtration and carbon pretreatment, and activated-carbon-treated secondary effluent. Studies indicated that spiral-wound reverse osmosis units were feasible for primary and activated sludge effluents with only moderate pretreatment, and that activated carbon pretreatment was unnecessary for successful treatment. Field tests using reverse osmosis at the Pomona Water Reclamation Plant of the Los Angeles County Sanitation District, California, resulted in permeates that were almost totally free of turbidity and of suspended and colloidal solid material. Removal of dissolved substances, including phosphate, COD, ammonia nitrogen, and nitrate, was also significant. Cost estimations for reverse osmosis operation and chemical membrane cleaning are provided. (Schulz-FIRL)

W77-12485

DEMONSTRATION OF A HIGH-RATE ACTIVATED SLUDGE SYSTEM.

Engineering-Science, Inc., Berkeley, Calif.

C. H. Huang, D. L. Feurstein, and E. L. Miller.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-240 005. Price codes: A08 in paper copy, A01 in microfiche. Report EPA-670/2-75-037, March 1975. 150 p, 25 fig, 22 tab, 46 ref, 1 appendix.

Descriptors: *Activated sludge, *Kinetics, *Nutrient removal, *Dewatering, *Model studies, Separation techniques, Nitrogen, Phosphorus, Biochemical oxygen demand, Sewage treatment, Filtration, Screens, Sludge treatment, *Waste water treatment. Identifiers: Chino(CA), High-rate activated sludge systems, Biological kinetics.

Objectives of this study in Chino, California, were to develop an optimum performance high-rate activated sludge system, describe the activated sludge process by kinetic analysis, relate nutrient removal to process operating parameters, evaluate performance of alternative mixed liquor solids separation systems, and examine the feasibility of using plant effluent for recreational purposes. Studies indicated that full scale systems could produce high quality effluent (BOD of 5 mg/liter) at high growth rates and at high substrate loading (3.6 mg BOD/mg MLVSS/day). Kinetic analyses of the system at Chino resulted in a yield coefficient of 0.92 mg MLVSS produced/mg BO removed, a decay constant of 0.027/day, a maximum substrate removal velocity of 4.1 mg BOD removed/mg MLVSS-day, a maximum specific growth rate of 3.8/day, and a half-saturation constant of 26 mg BOD/liter. Systems examined for activated sludge solids separation included vibratory screens, enhanced gravity separation, dissolved air flotation, and hydrocentrifugal cleaned screens. Studies at Chino indicated that screening was less efficient at solids removal than gravity settling. Nutrient requirements observed were 112 mg N/g BOD removed and 33 mg P/g BOD removed. Greater use of flow meters at various stages in the activated sludge process and more extensive research into dewatering techniques are recommended. (Schulz-FIRL)

W77-12486

UPGRADING EXISTING WASTEWATER TREATMENT PLANTS - CASE HISTORIES.

Hazen and Sawyer, New York.

Available from the National Technical Information Service, Springfield, VA as PB-258 818. Price codes: A03 in paper copy, A01 in microfiche. Prepared for EPA Office of Technology Transfer, Cincinnati, Ohio. August, 1972. 38 p, 12 fig, 7 tab.

Descriptors: *Activated sludge, *Design data, *Sewage treatment, *Capital costs, *Treatment facilities, Cost analysis, *Waste water treatment, Aeration, Design criteria, Trickling filters, Tertiary treatment, Sewage treatment, Sewage disposal. Identifiers: New York City(NY), Livermore(CA), Greensboro(NC).

Four cases of waste water treatment plant improvement involving the South Buffalo Creek waste water treatment plant at Greensboro, North

Carolina; a water reclamation plant at Livermore, California; the Wards Island waste water treatment plant in New York City; and an unnamed trickling filter plant are described. Upgrading of the South Buffalo Creek facility included expansion with phosphorus removal, special odor control measures, improved sludge handling, and effluent polishing with deep bed filters. Extensions to the Livermore water reclamation plant included preliminary treatment, roughing filters, activated sludge secondary treatment, pre- and post-chlorination, conversion of oxidation ponds to emergency holding ponds, additional sources for waste disposal, and more efficient nitrification and chlorination. Modifications to the Wards Island waste water treatment plant included alterations to final settling and aeration tanks. The expansion of an existing trickling filter facility with the addition of activated sludge treatment prior to filtration included diluting of raw waste water, covering of the preliminary tanks and trickling filter, ozonizing of exhaust gases for odor control, and pumping of sludge to a separate thickening tank before digestion. Treatment plant flow diagrams, design data, and capital costs are presented for all projects. (Schulz-FIRL)

W77-12488

LAND APPLICATION OF EFFLUENTS IN THE ROCKY MOUNTAIN-PRAIRIE REGION.

Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.

For primary bibliographic entry see Field 5E.

W77-12489

TECHNICAL ASSISTANCE PROJECT, UPPER EAGLE VALLEY SANITATION DISTRICT WASTEWATER TREATMENT FACILITY - AVON, COLORADO, MARCH-APRIL, 1973.

Environmental Protection Agency, Denver, Colo. Surveillance and Analysis Div.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 601. Price codes: A02 in paper copy, A01 in microfiche. Report S&A-TSB-23, June 1973. 17 p, 1 fig, 2 ref.

Descriptors: *Treatment facilities, *Colorado, *On-site tests, *Performance, *Sludge treatment, Aerobic treatment, Clarification, Monitoring, *Waste water treatment. Identifiers: *Upper Eagle Treatment Plant, Avon(CO), Vail(CO).

Findings of the Environmental Protection Agency (EPA) technical assistance project involving the Upper Eagle treatment plant near Vail, Colorado, are presented. Treatment at the Upper Eagle plant includes pretreatment with bar screening, aeration, clarification, aerobic digestion, chlorination, sludge drying, and discharge of effluents to the Eagle River. EPA control testing at the facility included measurements of dissolved oxygen, centrifuge turbidity, settleability, and sludge blanket depth. Results indicated that plant performance was hindered by inadequate control over the return sludge flow rate caused by insufficient manpower at the facility and inadequate physical control. Other limitations were posed by the size of the aeration basin, the aerobic digester capabilities, and leaky seals in the final clarifier. Biological activity and adequate sludge digestion were limited by cold temperatures, inadequate detention times, and excessive solids loading to the digester. Also, no provisions existed for the removal of floating material. Suggestions by the EPA for modifications and additions to the Upper Eagle plant included monitoring of effluent quality and influent flow rate, regular repair of clarifier seals, cooperative treatment by the Vail and Upper Eagle Plants, enlargement of the aeration basin, covering and/or heating of the digester, removal of floatable material during final clarification, and an increase in plant staffing. (Schulz-FIRL)

W77-12490

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

ROLE OF MODELS IN URBAN STORMWATER MANAGEMENT PLANNING.
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5G.
W77-12491

THE USE OF BACTERIA TO REDUCE CLOGGING OF SEWER LINES BY GREASE IN MUNICIPAL SEWAGE.
Maryland-National Capital Park and Planning Commission, Silver Spring.
For primary bibliographic entry see Field 5G.
W77-12492

DEVELOPMENT AND TESTING OF A WASTE-WATER RECYCLER AND HEATER.
CHEMTRIC Inc., Rosemont, Ill.
V. J. Guarino, and R. A. Bambenek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 961.
Price codes: A03 in paper copy, A01 in microfiche.
Report EPA-600/2-76-289, December 1976. 92 p, 24 fig, 20 tab, 1 append.

Descriptors: *Water reuse, *Distillation, *Vapor compression distillation, *Flash distillation, *Design data, Heated water, Laundering, Hospitals, Waste water treatment, Electric power demand, Water conservation, Model studies, Research and development.
Identifiers: Water heaters.

The major objective of this study was to produce and evaluate a device for the recovery of usable hot water from room-temperature waste water. The prototype examined was to use no more than 1800 watts of electrical power to produce 6 gallons of 165F water per hour. Flash evaporation and vapor compression processes were used for distillation. Design data for the prototype unit are presented. Tests using laundry water showed that the prototype unit was capable of producing sterile hot water with neutral pH as well as low suspended solids, COD, and turbidity, at a rate of 6 gallons per hour with an energy use of 229 watt-hours per gallon. Pretreatment was suggested for the reuse of hospital waste water, since ammonia and alcohols may be present in the distillation product. Annual operating costs for the unit, which is reported to conserve approximately 44,000 gallons of potable water per year, were estimated at \$717. (Schulz-FIRL)
W77-12493

COST ESTIMATING MANUAL—COMBINED SEWER OVERFLOW STORAGE AND TREATMENT.
Culp, Wesner, Culp-Clean Water Consultants, El Dorado Hills, Calif.
H. H. Benjes, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 359.
Price codes: A07 in paper copy, A01 in microfiche.
Report EPA-600/2-76-286, December 1976. 133 p, 30 ref, 19 tab, 72 fig, 2 append.

Descriptors: *Storm water, *Estimated costs, *Capital costs, *Cost analysis, *Energy, *Combined sewers, Costs, Overflow, Sewage treatment, Operating costs, Construction costs, Waste treatment, Sewerage, Treatment facilities, Waste water treatment.

Cost estimates for various processes associated with storm water treatment have been prepared according to plant size (5-200 mgd) and storage capacity (1-240 mgd). Fourteen process functions are examined: swirl flow regulator/concentrator, horizontal shaft rotary screen, stationary screen, vertical shaft rotary screen, air flotation, chlorination, granular media filtration, storage, flocculation, sedimentation, chemical feed systems, raw sewage pumping, sludge pumping, and flow measurement. Graphical presentations relate labor,

capital, operation, and maintenance costs and energy requirements to process design and capabilities. A method of projecting construction costs according to inflation rates and time of construction is presented. Examples of cost estimates for various processes are presented. (Schulz-FIRL)
W77-12494

CATCHBASIN TECHNOLOGY OVERVIEW AND ASSESSMENT.
Metcalf and Eddy, Inc., Palo Alto, Calif.
J. A. Lager, W. G. Smith, and G. Tchobanoglous.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 092.
Price codes: A07 in paper copy, A01 in microfiche.
Report EPA-600/2-77-051, May 1977. 129 p, 36 fig, 31 tab, 121 ref, 3 append.

Descriptors: *Storm water, *Urban runoff, *Watersheds(Basins), *Operation and maintenance, *Suspended solids, Design criteria, *Sewers, Combined sewers, Water pollution control, Urban drainage, Waste water treatment.

A survey of technical and economic information on catchbasins was conducted to enable more efficient planning and decision-making for urban runoff and collection systems. The report includes: a state-of-the-art review, a review of variables affecting catchbasin efficiency, hydraulic modeling analyses, an assessment of the role of catchbasins, an economic evaluation of alternative storm and combined sewer designs, and a review of recent developments and continuing program needs. The state-of-the-art survey provides background information on catchbasin design, maintenance, and use. Hydraulic modeling analyses indicate that catchbasins could effectively remove medium to very coarse sands from storm water runoff. Removal efficiency increases with increased particle size, decreasing flow velocity, and increased basin depth. Catchbasin cleaning is recommended when solids content exceeds 40-50% of the storage depth. A survey on existing catchment basins indicated that mixed performance for the 1,750,000 catchment basins in the United States is probably due to underfinanced and poorly monitored programs. Major alternatives to the use of catchment basins are sewer and street cleaning, the use of inlets and flow-attenuation devices, and separate storm water storage. Recommendations from this study include further evaluation of cost effectiveness, more accurate records of catchment performance, and field scale demonstrations of catchbasin cleaning programs. (Schulz-FIRL)
W77-12495

INVENTORY OF SEWAGE TREATMENT PLANTS FOR CHESAPEAKE BAY.
Chesapeake Research Consortium, Inc., Baltimore, Md.
L. M. Brush.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-241 005.
Price codes: A04 in paper copy, A01 in microfiche.
1974. 62 p, 29 fig, 1 tab.

Descriptors: *Treatment facilities, *Sewage treatment, *Municipal wastes, *Chesapeake Bay, Bays, Estuaries, Effluents, Treatment, Flow, Waste water treatment.

A survey of sewage treatment facilities in operation on Chesapeake Bay as of 1973 is presented. Municipal treatment plant locations are illustrated for 27 tidal tributaries which empty into the Chesapeake. The Chesapeake Bay area itself has been divided into 5 major basins. Data provided for each plant include: plant, state, plant number as defined by the resident state, flow, treatment level, and basin code. A plot, illustrating sewage treatment plants handling more than 5 mgd and cumulative effluent input along major segments of the bay, is presented. (Schulz-FIRL)
W77-12496

COUNTERMEASURES FOR POLLUTION FROM OVERFLOWS; THE STATE OF THE ART.
Municipal Environmental Research Lab., Edison, N.J. Storm and Combined Sewer Section.
For primary bibliographic entry see Field 5G.
W77-12497

WATER QUALITY, CONDUITS, AND GEOMETRICS.
National Research Council, Washington, D.C. Transportation Research Board.
For primary bibliographic entry see Field 8F.
W77-12499

COMPOSITE CONDUIT CONSTRUCTION FOR LOWER COST INSTALLATIONS AND IMPROVED PERFORMANCE.
For primary bibliographic entry see Field 8F.
W77-12501

FAILURE OF A CAST-IN-PLACE UNREINFORCED CONCRETE CONDUIT.
California State Dept. of Transportation, Sacramento. Div. of Construction and Research.
For primary bibliographic entry see Field 8F.
W77-12502

CONTINUING NEED FOR IMPROVED OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS.
General Accounting Office, Washington, D.C. Report to Congress by the Comptroller General of the United States, Report No. CED-77-46, April 11, 1977. 75 p, 1 fig, 3 tab.

Descriptors: *Waste water treatment, Facilities, *Operation and maintenance, *Costs, Personnel, Equipment, Design, Laboratory tests, Infiltration, Inflow, Capital costs, Permits, Water Quality Act, Inspection, *Treatment facilities.
Identifiers: Discharge permits.

The General Accounting Office (GAO) visited 28 plants constructed with Federal grant assistance in 6 states and noted that there were insufficient qualified plant operating personnel; inadequate budgets; inadequate controls over industrial wastes; inadequate laboratory controls; inadequate plant design and equipment; and infiltration/inflow problems. These problems adversely affect the high capital investment in waste treatment facilities and inhibit attainment of water quality goals. The GAO recommends that the Environmental Protection Agency (EPA) Administrator: (1) develop and publish guidelines specifying the operation and maintenance considerations affecting municipal permit applications; (2) revise the criteria for renewed discharge permits issued to waste treatment plants having major operation and maintenance problems; the permits should be tailored to individual needs; (3) require regularly scheduled operation and maintenance inspections in accordance with Agency guidelines, and documentation and reporting of the results to EPA; and (4) require all regional offices and encourage the states to maintain adequate technical assistance capability. EPA contends that specific operation and maintenance requirements should not be included in municipal permits, and that technical assistance should be provided by the private sector rather than EPA or the states. EPA estimates that the cost of operating and maintaining 21,059 waste treatment plants would total \$1.1 billion in fiscal year 1977. Although no Federal grants are authorized for operation and maintenance of these plants, EPA has a continuing interest in effective waste treatment and safeguarding investment of Federal funds. (Nessa-NC)
W77-12586

UNIFORM SLURRY SPREADING WITH A CENTER PIVOT IRRIGATION SYSTEM.
Valmont Industries, Inc., Valley, Neb.

J. A. Chapman, and R. G. Myers.

Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 11 p, 4 fig, 3 ref.

Descriptors: *Farm wastes, *Sprinkler irrigation, *Irrigation systems, Irrigation practices, Economics, Liquid wastes, Water reuse.
Identifiers: *Center pivot irrigation systems.

A design for the automated distribution of liquid manure through center-pivot irrigation systems has been developed. The design is functional and achieved its basic goals. Under many conditions it appears to be highly cost effective when compared to current liquid manure handling systems. (Skogerboe-Colorado State)
W77-12612

HISTORY, STATUS AND FUTURE OF DISTILLATION PROCESSES,

Watson Desalination Consultants, Manassas, Va.
For primary bibliographic entry see Field 3A.
W77-12611

STATE-OF-THE-ART OF MEMBRANE AND ION EXCHANGE DESALTING PROCESSES,

Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 3A.
W77-12632

BROMINE CHLORIDE: AN ALTERNATIVE DISINFECTANT TO CHLORINE,

Hawaii Univ., Honolulu. Water Resources Research Center.

For primary bibliographic entry see Field 5F.
W77-12634

METHOD OF PACKING MEDIA IN A TOWER OR BED,

Imperial Chemical Industries, Ltd., London (England).
J. Lunt.

U.S. Patent No 4,005,010, 5 p, 2 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 954, No 4, p 1655, January 25, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Water purification, Biological treatment, Filtration, Filters, Packed beds, Equipment.
Identifiers: Plastic packing media, Mesh sacks.

A method of packing a tower or bed with a media for the treatment of effluent and sewage comprises filling the tower or bed with openweave or open-mesh sacks containing the media. Plastic packing media are placed in open-weave or open-mesh sacks, the openings in the sacks being smaller than the smallest dimension of an individual plastic element. The plastic elements when wetted provide surfaces for growing bacteria and other micro-organisms as a biological film. Effluent and sewage are passed through the packed tower through the media and the sacks. Air is required to sustain the growth of bacteria. The biological film is allowed to pass through the media and the sacks as it from time to time is dislodged. Since the biological film that is dislodged from the wetted plastic element surfaces on which it grows is flushed through the system, the packing media need never be replaced for the effective life of the tower or bed. The material used in the construction of the sacks is inert to the chemical and biological attack. An advantage of plastic packing media over ceramic or metallic packing media is that the lower weight exerts less force on the retaining walls of the tower or bed. (Sinha-OEIS)
W77-12684

METHOD FOR TREATING SEPTIC TANK EFFLUENT SEEPAGE BEDS AND THE LIKE,

Wisconsin Alumni Research Foundation, Madison. (Assignee).

J. M. Markin.

U.S. Patent No 4,021,338, 7 p, 12 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 283, May 3, 1977.

Descriptors: *Patents, *Waste water treatment, *Soil disposal fields, *Waste disposal, Waste treatment, *Water pollution sources, Anaerobic conditions, Oxidation, Chemical reactions.
Identifiers: Hydrogen peroxide, Septic tank effluent.

When applied to a clogged seepage bed hydrogen peroxide oxidizes the bulk of the insoluble sulfides present in the clogged bed to harmless sulfur, soluble sulfates, and other oxy-sulfur anions, thereby destroying the toxic sulfides and releasing the heavy metal trace elements to the soil solution for microbial use. Some of the peroxide may decompose to water plus oxygen, either catalytically on soil particles or by heavy metal ions brought into solution by the oxidation of insoluble sulfides, or through enzymatic decomposition by catalases produced by organisms present in the bed. The free oxygen causes considerable turbulence in the bed, which loosens up the soil particles and pores, especially in the organically matted clogged area, and mechanically improves the distribution of the chemical throughout the bed and the permeability of the soil. The free oxygen can also be reduced in part to oxygen radical anions by the anaerobic bacteria in the bed. The hydrogen peroxide treatment can be carried out in various ways but to be fully effective the peroxide should reach the clogged, crusted anaerobic portion of the bed and not be diluted by water in the system. Peroxide treatment can also be used to forestall failure of the system. Such prophylactic treatment can be readily performed as part of routine service or maintenance of the septic system. (Sinha-OEIS)
W77-12688

SEWAGE TREATMENT SYSTEM,

R. E. Teller, and S. G. Zachar.

U.S. Patent No 4,021,347, 7 p, 6 gih, 13 ref; Official Gazette of the United States Patent Office, Vol 958, No 1, p 286, May 3, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Domestic wastes, Water pollution control, Water quality control, Aeration, Settling basins, Filtration, Chlorination, Oxidation, Ozone.

An improved sewage treatment system primarily for use with single or small multi-unit buildings, includes a horizontally elongated tank divided transversely into a primary, aeration compartment, a secondary, settling compartment and a tertiary, filtering compartment. In the first aspect of the invention, overflow of treated effluent from the tank enters a further treatment section, which may constitute a longitudinal extension of the tank, where the effluent is constrained by baffles to flow in an elongated path while having chlorine or ozone mixed with it to provide further purification. Another aspect of the invention resides in the structure of the filtering section where filter screens of different gauge or opening size are used to achieve a greater degree of purification. (Sinha-OEIS)
W77-12692

AERATED SEWERWAGE (SIC) EFFLUENT DISPOSAL SYSTEM,

A. J. Smith.

U.S. Patent No 4,021,348, 5 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, No 1, p 287, May 3, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Aeration, Bubbles, Equipment.

A sewage treatment system includes: a receptable for a liquid sewage pool forming a submerged trench having downward tapering side walls so that solids tend to collect in a narrow channel at the bottom of the trench; air injection means to inject air into the pool to form bubbles traveling down to the narrow channel and into contact with the solids; and guide means extending above and along the trench to guide the air injection means to travel lengthwise of the trench. The trench may extend in an endless path forming a labyrinth having a generally V-shaped cross section. The air injection means may comprise an elongated and generally upright tube extending above and below the pool surface. A sub-surface impeller associated with the tube causes gas such as air to be drawn down within the tube to form bubbles. The air injection means may be suspended to travel lengthwise to progressively treat the solids collecting at the bottom of the trench along its length. (Sinha-OEIS)
W77-12693

APPARATUS FOR CIRCULATING AND/OR AERATING A LIQUID,

J. R. Kaelin.

U.S. Patent No 4,021,349, 7 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 287, May 3, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Settling basins, Aeration, Aerobic conditions, Air entrainment, Mixing, Centrifugation, Equipment.

An apparatus circulates and/or aerates a liquid, especially waste water located in a tank or basin by means of a centrifugal impeller or rotor immersed in the liquid and rotatable about a vertical axis. The centrifugal impeller is equipped with a number of radially extending liquid conveying channels. The liquid conveying channels at the region of their outlet openings or mouths are curved in a vertical plane and are provided at the outlet openings with flow deflection surfaces so that the liquid emanating from the channels flows at an angle of at least 5 degrees relative to a horizontal plane towards the side of the impeller provided with an inlet opening. (Sinha-OEIS)
W77-12694

ROTATING MULTITUBE BIOCONTACTOR FOR TREATING SEWAGE,

M. Kato, I. Kato, S. Kato, Y. Kato, and T. Kato.

U.S. Patent No 4,022,689, 9 p, 11 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 738, May 10, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Biological treatment, Aerobic conditions, Mixing, Equipment.

A rotary multitube biocontactor has tubes of a predetermined length and diameter which are bundled in a pillar like form and are connected with each other and with an axle at the sectional center by means of welding. The tubes are at angles to the axle, the axle being mounted in bearings provided on a trough at the top of two sidewalls to enable the axle to be located close to the surface of water contained in the trough. The axle is rotated by a motor so that the tubes rotate in and out of the sewage resulting in the rapid development of aerobic micro-organisms on the inside and outside of the tubes and thereby achieving effective purification of the sewage by aerobic microorganisms.
W77-12700

MIXING CHAMBER FOR THICKENING SEWAGE SLUDGE BY MEANS OF A FLOCCULATION AGENT COMBINED WITH OVERFLOW DRAINAGE MEANS,

H. J. Heinrich.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

U.S. Patent No 4,022,691, 7 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 739, May 10, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Mixing, Separation techniques, Flocculation, Sludge treatment, Sludge disposal.

An apparatus is described which combines mixing and draining means with which thickened sludges can be dehydrated in an accelerated manner by the addition of a flocculation agent. The sewage is fed to the bottom of the mixing chamber, enters a mixing zone and flows upwardly into an overflow at the top and out through a diversion means for the thickened sludge leading to a sedimentation belt or to a press filter. The sludge leaving the mixing zone has a clear phase separation between water and flakes of solid substance. The flakes hover in a loosened up manner. In this stage water can be withdrawn right through the perforated screening walls relatively quickly and in a large quantity. Through the flow of the sludge the flakes will be prevented from settling in front of the holes of the screen walls since they are continuously carried along by the stream of the sludge. (Sinha-OEIS) W77-12701

APPARATUS FOR CLARIFICATION OF WASTE WATER OPERATING ON DISSOLVED AIR FLotation PROCESS,

M. Krofta.
U.S. Patent No 4,022,696, 8 p, 7 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 740-741, May 10, 1977.

Descriptors: *Patents, *Waste water treatment, *Water purification, *Separation techniques, Pulp wastes, Flotation, Skimming, Pulp and paper industry.

An apparatus for clarifying waste water in the paper, pulp, and like industries, is disclosed in which the waste water being treated is moved through the apparatus with minimum turbulence so that the flotation rate of suspended particles is brought closely to a theoretical value. The apparatus includes a flotation tank unique in that its height is low compared to its area. Inlet pipes for waste water are supported by a carriage which moves around the flotation tank supported on the outer edge of the tank and a runway towards the center of the tank. The clarified water is removed by pipes also supported by the carriage and so supported that advantage is taken of the movement of the carriage to effect a longer flotation path for the rising particles. (Sinha-OEIS) W77-12703

SEALED SEDIMENTATION DEVICE,

Envirotech Corp., Menlo Park, Calif. (Assignee).
P. J. Pankuch.
U.S. Patent No 4,022,697, 6 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 741, May 10, 1977.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Separation techniques, Settling basins, Gases, Structures, Equipment.

A gravity-type sedimentation unit includes a large liquid-holding tank equipped with a raking structure which rotates slowly to move the settled solids to a discharge sump formed in the bottom of the tank. The raking structures are usually driven by a gear mechanism. It is sometimes necessary to cover the thickening tanks to contain noxious and corrosive gases which are harmful to personnel and equipment. The object of this invention is the provision of a structural arrangement for sealing a sedimentation device of the peripheral drive type in order to contain fumes and vapors while enabling the use of a drive unit located outside the housing which rotates a raking structure in the set-

ting tank enclosed within the housing. A gas-tight seal is effected between the tank, the cover and the drive unit by the combination of an annular liquid-holding launder which is supported to surround the interior of the tank, a rigid U-shaped member which connects the drive unit to the raking structure with its lower portion submerged in the liquid held in the launder, and a continuous baffle-like wall extending from the tank cover downward into the space bounded by the submerged portion of the U-shaped member. (Sinha-OEIS) W77-12704

PROCESS FOR REMOVING HYDROCARBONS AND OTHER ORGANIC PRODUCTS FROM AQUEOUS FLUIDS,

Creusot-Loire, Paris (France). (Assignee).
A. Tribellini.
U.S. Patent No 3,905,901, 4 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 938, No 3, p 1234, September 16, 1975.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Effluents, *Water pollution control, *Water quality control, *Organic compounds, *Separation techniques, Chemical reactions.

The effluent to be treated is mixed with a hydrocarbon solvent insoluble in water, and passed through a bed of a solid complex consisting essentially of a solid substrate bearing free hydroxyl groups activated with 0.01 to 10 parts by weight of an acid halide per one part of the substrate and to which is covalently bound from 0.01 to 10 parts by weight of an amine selected from the primary aliphatic amines having from 6 to 20 carbon atoms and the primary aromatic amines having, attached to a phenyl ring, a linear hydrocarbon chain of 1 to 10 carbon atoms bearing the amine groups. The hydrocarbon solvent containing the hydrocarbons is thereby separated from the purified effluent. Better results may be obtained by pre-purifying the effluent by passing it through a bed composed of a complex of a mineral substrate to reduce the hydrocarbon content to about 20 ppm. (Sinha-OEIS) W77-12706

A NOTE ON THE USE OF ECONOMIC INCENTIVES IN WATER POLLUTION ABATEMENT,

Technical Univ. of Denmark, Lyngby. Dept. of Chemical Engineering Economics.

For primary bibliographic entry see Field 5G.

W77-12718

TECHNOLOGY AND ASSOCIATED COST FOR SULPHITE PULPING SPENT LIQUOR RECOVERY.

Abatement Compliance Branch, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, Economic and Technical Review Report EPS 3-WP-77-8, June, 1977. 82 p, 24 fig, 16 tab, 34 ref, append.

Descriptors: *Pulp and paper industry, *Sulfite liquors, *Chemical wastes, *Evaporation, *Incineration, Technology, Costs, *Pulp wastes, Waste treatment, *Canada.

Identifiers: *Pulping, *Recovery furnaces.

The purpose is to review the new technology and considerations of pulping spent liquor recovery. Only in-place technology is considered. The cost information deals with evaporation through incineration and recovery. Special emphasis is placed on the recovery of liquor from high yield pulping. The report presents an extensive review of proved new technology available to the industry and couples this information with sufficient details of theory to thoroughly explain the significance of these new developments as they are applicable to the Canadian pulp industry. Special emphasis is given to the Marathon Engineering Inc. (MEI)

process and other new recovery concepts. Mill energy considerations are also covered. The cost of liquor recovery is presented for seven different case examples. In these examples the mill production pulping base and yield are considered to be representative of existing or projected sulphite mill conditions in Canada. Cost data are presented for the MEI process, fluidized bed process, and more conventional liquor recovery involving a standard set of evaporators and burning in conventional recovery furnaces. (WATDOC) W77-12772

EFFECT OF CITRATE AND CARBONATE BASED DETERGENTS ON WASTEWATER CHARACTERISTICS AND TREATMENT,

Environmental Protection Service, Ottawa (Ontario). Water Technology Centre.
E. E. Shannon, N. W. Schmidtke, and P. J. A. Fowle.
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 61, 1977. 37 p, 8 fig, 14 tab, 16 ref, append. 73-3-7.

Descriptors: *Detergents, *Phosphates, *Carbonates, *Waste water treatment, Chemical wastes, Sludge, Activated sludge, Sludge treatment, Analysis, Effects, *Canada, Treatment facilities.
Identifiers: Ontario.

This study examined the effects of citrate and carbonate based detergents on primary and activated sludge waste treatment processes when phosphorus removal by chemical precipitation was practised. Jar tests, continuous flow bench scale activated sludge reactors, as well as pilot scale and full scale treatment systems, were used in this investigation. Results showed that for primary treatment systems a complete citrate substitution may increase chemical (ferric chloride, alum or lime) requirements for phosphorus removal, whereas a complete carbonate substitution would have no significant effect on systems using lime for phosphorus removal. In general, for activated sludge systems the impact upon phosphorus removal and treatment plant performance by complete substitution to citrate based detergents was determined to be negligible. (WATDOC) W77-12773

MEAT AND POULTRY PRODUCTS PLANT LIQUID EFFLUENT REGULATIONS AND GUIDELINES.

Environment Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5G.
W77-12774

FULL SCALE STUDIES ON THE THERMOPHILIC ANAEROBIC DIGESTION PROCESS,

Ontario Ministry of the Environment, Toronto.
J. Smart, and B. I. Boyko.
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 59, 1977. Environmental Protection Service, Environment Canada, Ottawa, Canada, 79 p, 7 fig, 12 tab, 20 ref, 4 append. 73-1-29.

Descriptors: *Anaerobic digestion, *Thermophilic bacteria, *Microorganisms, Heating, Heat resistance, Sludge digestion, *Waste water treatment.
Identifiers: *Thermophilic system, *Mesophilic system.

A plant scale thermophilic anaerobic digestion study was conducted study was conducted to assess the feasibility and performance and to provide economic guidelines for the process as compared with the conventional mesophilic system. The study was conducted in four distinct phases; the first three at specific applied digester loadings, with the fourth and final phase studying the effect of shock loadings. A full scale mesophilic system,

operating on the same raw sludge feed, was used as a comparison. The study proved full scale thermophilic digestion to be feasible and capable of sludge stabilization performance similar to the mesophilic control unit, but at more rigorous applied digester loading levels. The final phase of the study showed that widely and frequently varying applied digester loadings had little effect upon the thermophilic process, which proved to be very flexible in producing a good all round performance under the range of shock loadings applied. While no actual operating cost comparison was made between the two digestion systems, estimates of energy requirements based on the data obtained showed that requirements would be slightly greater for the thermophilic process. However, the magnitude of the increase was such that conversion of existing overload mesophilic systems to thermophilic operation would be feasible and acceptable in view of the likely benefits to be obtained. (WATDOC)

W77-12775

SCREENING DEMONSTRATION FOR THREE FISH PROCESSING PLANT EFFLUENTS.
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
G. Lindsay, and N. W. Schmidtkne.
Technology Development Report EPS 4-WP-77-4, June 1977. 36 p., 11 fig, 5 tab, 4 ref, 2 append.

Descriptors: Fish, Effluents, Industrial plants, *Industrial wastes, Industrial production, Solid wastes, Liquid wastes, *Screens, Filters, Suspended solids, Herrings, Shrimp, Perches, Descaling, Operation and Maintenance, *Waste water treatment.
Identifiers: *Fish processing plants, *Screening demonstration, Tangential screen, Rotary screen.

A study to evaluate solids removal effectiveness using fine mesh screening devices was conducted at two fish processing plants in the Atlantic region. A further objective consisted of demonstrating to the fish processing industry technology for the removal of solids from fish processing plant effluents. Suspended solids removal effectiveness using screens on liquid effluents from herring processing, shrimp processing and a redfish descaling operation were evaluated. The study demonstrated that after coarse screening, a 24 mesh tangential screen was capable of reducing the suspended solids concentration from a herring filleting process effluent by 42 percent, 50 percent of the time. Similarly, for a shrimp processing effluent, the suspended solids concentration was reduced by 60 percent, 50 percent of the time. A 30 mesh rotary screen was effective in removing 30 percent of the suspended solids from a redfish descaling process effluent 50 percent of the time. Few operational problems were encountered. (WATDOC)

W77-12776

LAND DISPOSAL OF SEWAGE SLUDGE, VOLUME IV (APRIL, 1975 - MARCH, 1976),
Guelph Univ. (Ontario).
For primary bibliographic entry see Field 5E.
W77-12791

TASTES AND ODORS IN WATER SUPPLIES-A REVIEW.
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5F.
W77-12794

USE OF REVERSE OSMOSIS FOR VALUABLE BY-PRODUCTS RECOVERY.
Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 3A.
W77-12795

ATTENUATION OF WASTE WATER ELUTRIATED THROUGH GLACIAL OUTWASH.
Wisconsin Univ.-Oshkosh. Dept. of Geology.
C. W. Feiter Jr.
Ground Water, Vol. 15, No. 5, p 365-371, September-October 1977. 3 fig, 3 tab, 20 ref.

Descriptors: *Waste water treatment, *Tertiary treatment, *Laboratory tests, *Glacial drift, Soil filters, Adsorption, Surfaces, Heavy metals, Ion exchange, Recharge, Cadmium, Lead, Ammonia, Nitrification, Phosphorus.

Secondarily treated waste water was added to plastic columns filled with calcareous glacial outwash soil for a period of 10 weeks. More than 99% of the phosphorus was retained in the upper 50 cm of the soil, primarily due to adsorption. Ammonia, nitrite, and organic nitrogen were nitrified biologically to nitrate nitrogen. There was no measurable mercury in the column effluent, and it was present in only 2 samples of the waste water. About 30% of the cadmium was removed by ion exchange in the soil columns. Lead was not removed, probably due to the prior exhaustion of the lead exchange sites. (Humphreys-ISWS)

W77-12814

DETENTION TANK FOR COMBINED SEWER OVERFLOW, MILWAUKEE, WISCONSIN, DEMONSTRATION PROJECT.
Milwaukee Dept. of Public Works, Wis.; and Consoer, Townsend and Associates, Chicago, Ill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-250 427, Price codes: A14 in paper copy, A01 in microfiche. Report EPA-600/2-75-071, December 1975. 306 p, 81 fig, 49 tab, 5 ref, 1 append. EPA 11020FAU.

Descriptors: *Combined sewers, *Overflow, *Detention reservoirs, *Wisconsin, Data collections, Evaluation, Storm runoff, Pollution, Water pollution, Water pollution control, Water quality, Water quality control, Sewers, Costs, Economics, Model studies, Mathematical models, Computer models, Equipment, Monitoring, Automation, Sampling, Civil engineering.
Identifiers: *Milwaukee(Wis).

The City of Milwaukee evaluated the merits of detention tanks as a practical method for abatement of combined sewer overflow pollutional discharges from urban areas. A 3.9 million gallon combined sewer overflow detention tank was constructed to intercept overflow from a 570 acre segment of the City's combined sewer area. As part of the evaluation program, an extensive sewer and river monitoring program was conducted, utilizing 11 automated monitoring stations. The monitoring program provided data utilized with a mathematical detention tank model to evaluate performance of the project detention tank and provided a basis for other design and planning situations. Based upon approximately 5 years of data and modeling studies, detention tanks were shown to be effective in preventing a large portion of the contaminants found in combined sewer overflow from entering receiving waters. General information and methods were developed for sizing and for estimating costs of detention tanks for other areas. This information was utilized to establish preliminary cost estimates for providing similar facilities to serve the entire combined sewer area tributary to the Milwaukee River in the City. (Sims-ISWS)

W77-12824

WATER QUALITY RESEARCH.
For primary bibliographic entry see Field 5G.
W77-12900

IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT (REVIEW OF THE SOUTHWEST SEWER DIS-

TRICT, SUFFOLK COUNTY, LONG ISLAND, NEW YORK).
For primary bibliographic entry see Field 5G.
W77-12903

AMERICAN PAPER INSTITUTE V TRAIN (CHALLENGE TO EFFLUENT LIMITATION GUIDELINES FOR PULP, PAPER AND PAPERBOARD INDUSTRY).
For primary bibliographic entry see Field 6E.
W77-12905

CITY OF NEW HAVEN V TRAIN (CITY CHALLENGE TO AGENCY ACTION REGARDING SITING OF SECONDARY SEWAGE TREATMENT FACILITY).
For primary bibliographic entry see Field 6E.
W77-12906

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 6. ELECTRON IRRADIATION, SEWAGE SLUDGE AND AQUACULTURE.
Massachusetts Inst. of Tech. Cambridge. Marine Industry Advisory Services.
Sea Grant Program Report MITSG-77-14, Index No. 77-714-Zvl, April 1, 1977. 27 p, 1 fig, 36 ref.

Descriptors: *Aquaculture, *Irradiation, *Sewage sludge, *Sewage treatment, *Water quality control, Sludge disposal, Nutrients, Waste treatment.

The current state of electron irradiation as a sludge sterilization method is reviewed. The costs with existing methods are compared and some economic projections about the production and sale of sludge as fertilizer are made. Given that the irradiation treatment of sewage sludge produces a nutrient-rich, sterile medium for the culture of microorganisms, a controlled ecosystem could be designed using this nutrient energy base upon which to structure a food web capable of supporting the commercial production of marketable human or animal foods. Such a contrived ecosystem might be managed intensively to achieve high efficiency of production of desired high-value aquatic species. Alternatively, extensive culture systems based on irradiated sludge might be managed to produce large quantities of animal feed composed essentially of algal or fungal single-cell proteins. (NOAA)

W77-12915

BIOLOGICAL TRANSFORMATION PLANT FOR REFUSE AND SLUDGE-WITH PRE-MIXER FOR TREATMENT CHAMBER.
J. R. Kaelin.
French Patent FR 2312-474. Issued January 28, 1977. Derwent French Patents Abstracts, Vol. Y, No. 11, p D8, April, 1977.

Descriptors: *Patents, *Biological treatment, *Treatment facilities, Domestic wastes, Sludge, Humus, Heat treatment, Oxygen, Aeration, Temperature, Gases, Waste treatment, Ultimate disposal.

A patent was issued for a treatment facility to process domestic wastes and/or thickened sludge for humus production. The material is mixed in the upper portion of a treatment chamber. The mixer exterior is heated by air from the biological transformation process. The material is softened during treatment. Hot, dry air enters through a pipe and humid, oxygen-depleted air is removed. The entering air may be enriched with oxygen. Blades are arranged for gas diffusion and aeration. Sludge enters by pipe, after being dried to 75% of its moisture content. It then undergoes partial aeration in a preliminary mixer. The sludge is heated and, if necessary, mixed with treated material for regulation of temperature, consistency, and biological condition. The gaseous current in the treatment chamber accelerates the heat from the biological transformation process. (Collins-FIRL)

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

W77-12918

RADIOACTIVE TREATMENT OF SEWAGE SLUDGE-IN IRRADIATION CHAMBER SUNK IN PIT BELOW WATER TANK AS RADIATION SCREEN.

Netherlands Patent NL 7512-546. Issued March 15, 1977. Derwent Netherlands Patents Abstracts, Vol. Y, No. 13, p D1, May, 1977.

Descriptors: *Patents, *Irradiation, Sludge treatment, Equipment, Pumps, Water purification, Design, Waste water treatment.

A patent was issued for an irradiation treatment system for sewage sludge. A vertical hollow cylinder is suspended in an irradiation chamber. Its annular jacket contains radioactive elements. The fluid circulates along the jacket's inner and outer walls alternately. A tank above this chamber is filled with a liquid to a level that provides protection from radiation. This tank is connected to the chamber jacket space and should form a storage sump for radioactive elements. A centrifugal pump should be used to circulate the waste fluid. Water can be used as a screen against radiation. (Collins-FIRL)

W77-12919

RECIRCULATING SEWERAGE SYSTEM, Koehler-Dayton, Inc., New Britain, Conn. (Assignee).

R. B. Davis. United States Patent 4,017,395. Issued April 12, 1977. Official Gazette of the United States Patent Office, Vol. 957, No. 2, p 712, April, 1977. 1 fig.

Descriptors: *Patents, *Water reuse, Sewage treatment, Filtration, Sewage effluents, Liquid wastes, Equipment, Domestic wastes, Water conservation, Waste water treatment.

A patent was issued for a recirculating sewage system and toilet. Wastes are filtered after flushing and mixed with bath water from a reservoir for this purpose. Solids remaining after filtration are washed into a solids collection area. The collected filtrate is directed back to the toilet for the next flushing. (Collins-FIRL)

W77-12921

METHOD OF REDUCING LEAD AND ACID WASTE CONTAMINATION IN BATTERY PLANT OPERATION, Globe-Union, Inc., Milwaukee, Wis. (Assignee).

W. A. Blann. United States Patent 4,024,055. Issued May 17, 1977. Official Gazette of the United States Patent Office, Vol. 958, No. 3, p 1192-1193, May, 1977. 1 fig.

Descriptors: *Patents, *Acids, *Lead, *Metals, *Neutralization, Industrial wastes, Hydrogen ion concentration, Suspended solids, Separation techniques, Waste water treatment.

Identifiers: Sulfuric acid, Lead-acid battery manufacturing.

A patent was issued for a technique to neutralize sulfuric acid, lower pH, and reduce sulfate ion content in waste water from a lead-acid battery manufacturing plant. Waste water with sulfuric acid is mixed with waste battery paste containing lead oxide to form a reaction mixture. The waste battery paste, as the neutralizing agent, is added to produce a reaction slurry pH of 5.5 to 8.5. This forms an insoluble sulfate precipitate. The effluent is passed to another agitated reaction zone, and on to a settling and precipitation zone. Lead sulfate and solids are separated by gravity. The neutralized aqueous portion of the slurry, with a pH of 5.5 to 8.5, is removed. Lead sulfate solids are recovered for conversion to lead and lead oxide, and are recycled as battery paste. (Collins-FIRL)

W77-12922

DISINFECTION SYSTEM AND METHOD,

Houdaille Industries, Inc., Buffalo, New York. (Assignee).

M. G. Mandt.

United States Patent 4,019,983. Issued April 26, 1977. Official Gazette of the United States Patent Office, Vol. 957, No. 4, p 1565, April, 1977. 1 fig.

Descriptors: *Patents, *Disinfection, Sewage effluents, Equipment, Water purification, Bacteria, Coliforms, Viruses, Microorganisms, Waste water treatment.

A patent was issued for a sewage disinfection method and system. Sewage effluent is continuously mixed and passed to a disinfection zone, while maintaining a turbulent energy dissipation level in the mixing zone of at least 5 sec to the minus one. Thus, the fluid disinfectant and the effluent are sufficiently mixed to produce a toxic environment for organism inactivation. The process produces a treated effluent with a 99.9% bacterial kill measured by fecal coliform removal and a viral kill rate of 99% measured by f2 virus removal. (Collins-FIRL)

W77-12923

OXIDATION OF REFRACTORY ORGANICS IN AQUEOUS WASTE STREAMS BY HYDROGEN PEROXIDE AND ULTRAVIOLET LIGHT,

Office of the Secretary (Navy). Washington, D.C. (Assignee).

E. Koubek.

United States Patent 4,012,321. Issued March 15, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 3, p 958, March, 1977. 1 fig.

Descriptors: *Patents, *Oxidation, *Chemicals, *Ultraviolet radiation, *Organic matter, *Chemical oxygen demand, Liquid wastes, Light, Equipment, Water purification, Effluents, Waste water treatment.

Identifiers: Hydrogen peroxide.

A patent was issued for a method to lower COD in aqueous wastes by using hydrogen peroxide and ultraviolet radiation. Waste stream COD is measured and an amount of hydrogen peroxide (as grams), no less than 2.1 times the measured COD, is added. The mixture is then agitated and moved through a container where it is irradiated at a wavelength no greater than 2600 Angstroms. (Collins-FIRL)

W77-12924

SEWAGE TREATMENT PROCESS,

Equacon Corp., Matawan, New Jersey. (Assignee).

J. Kreuter.

United States Patent 4,013,552. Issued March 22, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 4, p 1378, March, 1977. 1 fig.

Descriptors: *Patents, *Sound waves, *Biological treatment, *Microorganisms, Oxidation, Aerobic treatment, Organic matter, Oxygen, Sewage treatment, Waste water treatment.

A patent was issued for a sonobioaeration process that utilizes an electroacoustic horn to treat sewage. The horn is exposed to air and the sewage, converted to a thin film, is applied to the horn. Ultrasonic energy is transmitted through the horn to atomize the film. This process reduces liquid particle size and surrounds the particles with air to provide more oxygen to the aerobic organisms. The microorganisms are then used in a biochemical oxidation process to convert organic matter to a more stable compound. (Collins-FIRL)

W77-12925

SEWAGE TREATMENT AERATION SYSTEMS, Water Pollution Control Corp., Milwaukee, Wis. (Assignee).

P. M. Thayer.

United States Patent 4,012,470. Issued March 15, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 3, p 998, March, 1977. 1 fig.

Descriptors: *Patents, *Aeration, *Equipment, Mechanical engineering, Sewage treatment, Hydraulic equipment, Waste water treatment.

A patent was issued for an aeration treatment system. The system was composed of header means arranged in a tank with diffusers spaced at longitudinal intervals along them. The orientation of diffusers with regard to the tank can be adjusted by rotation of the header means. (Collins-FIRL)

W77-12926

WASTE WATER TREATMENT,

Swift and Co., Chicago, Ill. (Assignee).

E. R. Ramirez.

United States Patent 4,012,319. Issued March 15, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 3, p 958, March, 1977.

Descriptors: *Patents, *Coagulation, *Flotation, *Electrolysis, Suspended solids, Electrodes, Equipment, Separation techniques, Waste water treatment.

A patent was issued for a waste water treatment process involving the coagulation, agglomeration, and flotation of suspended and dissolved materials. Waste water flows along an electrode grid in which the current gradually diminishes in density. The greatest density is at the influent end of the flow path. This process forms microbubbles by electrolytic decomposition of waste water. A high water turbulence in the waste water is created at the influent end and maintained within and above the grid by the microbubbles. (Collins-FIRL)

W77-12927

GERMICIDAL SOLUTIONS AND METHODS FOR PRESERVING AND PURIFYING MILK, OTHER BEVERAGES, FOODS, WATER AND SEWAGE EFFLUENT,

Lever Brothers Co., New York. (Assignee).

L. J. Vinson, and L. P. Cancro.

United States Patent 4,022,882. Issued May 10, 1977. Official Gazette of the United States Patent Office, Vol. 958, No. 2, p 785, May, 1977.

Descriptors: *Patents, *Pesticides, *Water purification, Sterilants, Chemicals, Iodine, Waste water treatment, Aqueous solutions, Liquids.

Identifiers: Hydrazine, Polyvinyl pyrrolidone, Germicides.

A patent was issued for a germicidal solution which could be applied to the treatment of water and sewage effluent. The solution was composed of hydrazine, elemental iodine, and polyvinyl pyrrolidone dissolved in water. A quantity of hydrazine was used which would dissolve the iodine and overcome its color. The amount of iodine employed was 100 grams and that of polyvinyl pyrrolidone was 20-100 grams. (Collins-FIRL)

W77-12928

METHOD FOR TREATING SEPTIC TANK EFFLUENT SEEPAGE BEDS AND THE LIKE, Wisconsin Alumni Research Foundation, Madison. (Assignee).

J. M. Harkin.

United States Patent 4,021,338. Issued May 3, 1977. Official Gazette of the United States Patent Office, Vol. 958, No. 1, p 283, May, 1977.

Descriptors: *Patents, *Septic tanks, *Seepage, *Seepage control, Liquid wastes, Waste water treatment, Leakage, Domestic wastes, Waste water treatment, Chemical treatment.

Identifiers: Hydrogen peroxide.

A patent was issued for a process to treat clogged or crusted and ponded effluent seepage beds of

septic systems. The septic tank is pumped to lower the liquid below the effluent outlet level to reduce the amount of water ponded in the seepage bed. Hydrogen peroxide is applied in quantities sufficient to increase the seepage bed permeability and to enhance its functioning. (Collins-FIRL)
W77-12929

MIXING CHAMBER FOR THICKENING SEWAGE SLUDGE BY MEANS OF A FLOCCULATION AGENT COMBINED WITH OVERFLOW DRAINAGE MEANS,
H. J. Heinrich.
United States Patent 4,022,691. Issued May 10, 1977. Official Gazette of the United States Patent Office, Vol. 958, No. 2, p 739, May, 1977. 1 fig.

Descriptors: *Patents, *Flocculation, Equipment, Overflow, Dewatering, Sewage effluents, Sludge treatment, Mechanical engineering, Waste water treatment.
Identifiers: Sludge thickening.

A patent was issued for a mixing chamber to thicken sludge. There is a cylindrical housing with a cup-like bottom and a widened upper area. A mixing area is defined by an agitator in the lower part. A sewage inlet is attached at the lower end. A pipe for flocculant addition extends through the inlet. Thickening occurs in the mixing area. An annular chamber is formed at the wider upper portion by a perforated inner wall and an outer wall spaced from the inner wall. The perforated construction provides dewatering for the thickened sludge. A pipe from the dewatering area delivers thickened sludge to a drainage system. Provision is made for additional drainage or dewatering and sludge storage or conveyance. (Collins-FIRL)
W77-12932

SEWAGE CLARIFIER SYSTEM,
C. D. Hughes.
United States Patent 4,024,060. Issued May 17, 1977. Official Gazette of the United States Patent Office, Vol. 958, No. 3, p 1194, May, 1977. 1 fig.

Descriptors: *Patents, *Water purification, Equipment, Air, Sedimentation, Ponds, Sewage treatment, Waste water treatment, Design.

A patent was issued for a tube clarifier system to treat sewage effluent. The clarifier is connected to a main pond and to a compressed air source. A settling conduit is connected to the pond at one end, and to an outlet and air lock at the other end. The air lock structure includes a U tube chamber connected to the discharge means and to an inverted U tube chamber which has a connection with the compressed air source. Means are provided for the creation of back pressure and its release. A second air lock assembly is contained within the discharge tube. (Collins-FIRL)
W77-12933

WASTE WATER TREATMENT METHOD AND APPARATUS,
Miura Engineering International Co. Ltd., Osaka (Japan). (Assignee).
M. Miura, H. Matubayasi, and S. Iwai.
United States Patent 4,039,447. Issued August 2, 1977. Official Gazette of the United States Patent Office, Vol 961, No 1, p 256, August, 1977. 1 fig.

Descriptors: *Separation techniques, *Flocculation, Magnetic studies, *Patents, Design data, Suspended solids, Waste water treatment.
Identifiers: *Magnetic separation.

A method of waste water treatment using magnetic powder has been patented. Flocculated waste water to which magnetic powder has been added is continuously fed into a two-chambered tank which contains a number of rotating magnetic discs. Co-flocs of magnetic powder and suspended solids are collected on the magnetic discs, removed from the

treatment tank, and then separated by agitation to allow recovery of the powder. The treatment apparatus itself is divided into a large chamber for collecting co-flocs and a small chamber for separating them. The rotary magnetic discs are attached to a rotating shaft which extends through both chambers. A scraper is used to remove co-flocs from the discs for separation in a smashing tank. (Schulz-FIRL)
W77-12934

SEWAGE TREATMENT APPARATUS,
H. P. Peasley.
United States Patent 4,036,754. Issued July 19, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 3, p 1271-1272, July, 1977.

Descriptors: *Sewage treatment, *Biological treatment, *Patents, *Clarification, *Suspended solids, Design data, Effluents, Aerobic treatment, Digestion, Waste water treatment.

A waste water treatment apparatus for the clarification of a mixed liquor of sewage water and suspended solids by bacterial degradation has been patented. Mixed liquor is aerated and circulated in a main treatment tank which also has a smaller internal clarification compartment. An auxiliary compartment is provided for overflow from the main tank. The clarification compartment and main tank can be periodically backflushed. A digester compartment is attached to the side of the main tank for bacterial treatment of raw sewage. When sewage in the tank reaches a predetermined level, the digester tank is filled by overflow from the main tank via a weir. Air is injected into the digester tank to aerate the sewage and maintain solid materials in suspension. Clarified effluent is removed from the clarification tank through a longitudinal slot on the bottom of the compartment. (Schulz-FIRL)
W77-12935

METHOD FOR THE TREATMENT OF WASTE-WATER,
Autotrol Corp., Milwaukee, Wis. (Assignee).
W. N. Torpey.
United States Patent 4,035,290. Issued July 12, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 2, p 777-778, July, 1977.

Descriptors: *Patents, *Waste water treatment, *Biological treatment, *Equipment, Biodegradation, Waste treatment, Water purification.
Identifiers: *Rotating biological contactors.

A patent for the continuous treatment of waste water has been issued. The method utilizes a rectangular treatment tank which contains an upper biological treatment zone and a lower settling zone, separated by a horizontal baffle. The biological treatment zone is divided longitudinally into three bays which contain rows of biological contactors parallel to the flow direction of the waste water which enters and exits at opposite ends of the tank. Waste water is introduced into the two outer bays where it is treated by the rotating biological contactors. The two parallel streams of waste water are combined in the center bay and treated further while flowing back in the direction of the inlet tank. The combined stream is conducted to the lower settling tank and the flow reversed again. Treated waste water is removed via the outlet end of the lower settling tank. (Schulz-FIRL)
W77-12936

WASTE WATER TREATMENT APPARATUS,
Ontario Research Foundation, Sheridan Park. (Assignee).
F. Besik.
United States Patent 4,033,875. Issued July 5, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 1, p 307-308, July, 1977. 1 fig.

Descriptors: *Waste water treatment, *Equipment, *Patents, *Treatment, *Water pollution treatment, Instrumentation, Liquid wastes.

A patent has been issued for an apparatus which treats waste water containing a variety of contaminants. The apparatus consists of a cylindrical container having a truncated cone at the lower end, into which is placed an inverted funnel. Untreated waste water is pumped in through the base of the container in the truncated cone portion for first treatment. Treated waste water is discharged from a pipe at the top of the cylinder. A riser tube extending up through the container conducts material upward through the container, and also contains a gas feed tube for discharge at the lower end of the riser. (Schulz-FIRL)
W77-12937

APPARATUS FOR THE TREATMENT OF LIQUIDS,
Hager and Elsaesser, Stuttgart-Vaihingen (West Germany). (Assignee).
K. Marquardt, and R. Buchholz.
United States Patent 4,033,874. Issued July 5, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 1, p 307, July, 1977. 1 fig.

Descriptors: *Separation techniques, *Solvent extractions, *Liquid wastes, *Waste water treatment, *Equipment, Solvents, Waste treatment, Patents.

An apparatus for liquid-solid separations is described. A treatment column containing treatment material, a solvent extraction column, and a washing column are joined to form a closed system. Connections are provided for the addition and removal of washing liquid, solvent, treatment material, and waste water. Volume adjustment is accomplished by telescopically adjusted pipes that extend into the treatment and washing columns depthwise. (Schulz-FIRL)
W77-12938

PHOSPHORUS REMOVAL FROM WASTE WATER,
Ewing Engineering Co., Milwaukee, Wis. (Assignee).
M. J. Bykowski, and L. Ewing.
United States Patent 4,029,575. Issued June 18, 1972. Official Gazette of the United States Patent Office, Vol. 959, No. 2, p 751, June, 1977. 1 fig.

Descriptors: *Phosphorus compounds, *Nutrient removal, *Patents, Phosphorus, Aerobic treatment, Waste treatment, Anaerobic digestion, Suspended solids, Waste water treatment.

A patent for a process which treats waste water containing dissolved phosphorus compounds is described. The aqueous reaction products of elemental iron are mixed with waste water and are exposed alternately to anaerobic and aerobic conditions. The resulting liquid-solid suspension is clarified. Suspended solids, including insolubilized phosphorus compounds, are removed. (Schulz-FIRL)
W77-12939

PROCESS FOR TREATING MUNICIPAL WASTES TO PRODUCE A FUEL,
Guaranty Performance Co., Inc., Independence, Kans. (Assignee).
For primary bibliographic entry see Field 5E.
W77-12940

DISPOSAL METHOD AND USE OF SEWAGE SLUDGE,
IU Conversion Systems, Inc., Philadelphia, Pa. (Assignee).
For primary bibliographic entry see Field 5E.
W77-12941

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

AEROBIC SEWAGE DIGESTION PROCESS (42 C. PROCESS), D. A. Rein.

United States Patent 4,026,793. Issued May 31, 1977. Official Gazette of the United States Patent Office, Vol 958, No 5, p 2118-2119, May, 1977. 1 fig.

Descriptors: *Patents, *Aerobic bacteria, *Suspended solids, *Biological treatment, Microorganisms, Temperature, Oxygen, Sludge treatment, Activated sludge, Waste water treatment.

A patent was issued for an aerobic sewage digestion process. The process was designed to biologically reduce the solids content of an aqueous, biodegradable, organic sludge waste activated sludge. The sludge was first introduced into a vessel where total volatile solids concentration was maintained at less than 2.5% by weight. Sludge temperature was maintained in the range of 38-46 C, while oxygen was added to promote the growth of Monadidae protozoa and aerobically digest the sludge in their presence. (Collins-FIRL)
W77-12942

WASTE WATER TREATMENT APPARATUS BY BIOLOGICAL ACTION, Unitika Ltd., Amagasaki (Japan), (Assignee). K. Akai.

United States Patent 4,026,802. Issued May 31, 1977. Official Gazette of the United States Patent Office, Vol 958, No 5, p 2121, May, 1977. 1 fig.

Descriptors: *Patents, *Treatment facilities, *Mechanical equipment, *Biological treatment, Liquid wastes, Filters, Water purification, Filtration, Separation techniques, Waste water treatment.

A patent was issued for a small-scale biological treatment apparatus for waste water treatment. The plant contained a tank with a water outlet and overflow means. The tank was fitted with several individual biological filter beds and a central longitudinal partition. The filters were separated and provided with a means for rotation around the partition. Water was circulated around the partition by a diffuser. The filter beds can be washed while they are above the water level. (Collins-FIRL)
W77-12943

EVAPORATION OF TREATED WASTE WATER, A. J. Smith.

United States Patent 4,039,451. Issued August 2, 1977. Official Gazette of the United States Patent Office, Vol 961, No 1, p 257-258, August, 1977.

Descriptors: *Evaporators, *Drying, *Patents, *Design data, *Sewage treatment, Evaporation, Septic tanks, Filtration, Waste water treatment.

A patent for a waste water evaporation system is described. The system includes a horizontally elongated evaporation bed which contains an upper layer of rock pieces, a median layer of sand, and a lower rock layer. Waste water is recirculated through the layers by a sump system which collects excess water from the lower rock layer and pumps it through the upper rock layer. Septic tank contents are piped to the upper rock layer for slow percolation through the bed and subsequent evaporation. (Schulz-FIRL)
W77-12945

PROCESS AND APPARATUS FOR THE TREATMENT OF WATER-CONTAINING SUBSTANCES AND APPLICATION OF THIS METHOD FOR THE PREPARATION OF PASTEURIZED DRIED SLUDGE,

Patelhold Patentverwertungs- und Elektro-Holding Co., Glarus (Switzerland). (Assignee).
J. Galliker.

United States Patent 4,043,047. Issued August 23, 1977. Official Gazette of the United States Patent Office, Vol 961, No 4, p 1469, August, 1977.

Descriptors: *Dewatering, *Separation techniques, *Heating, *Heat treatment, *Drying, Equipment, Patents, Sludge treatment, Electrical equipment, Waste water treatment.

A process for drying water-containing substances, including sludge, has been patented. The water-containing substance is conveyed to the first treatment station, where elongated electrodes energized by alternating current for heating purposes dry the substance. The pre-dessicated substance is then transported to a second treatment station, where it is dielectrically heated to remove all but a few percent of the initial water content. The dielectric heat is furnished by condenser plates which are powered by a high-frequency source. (Schulz-FIRL)
W77-12946

APPARATUS FOR REMOVING SOLID MATERIAL FROM SEWAGE OR OTHER LIQUID,

Jones and Attwood Ltd., Stourbridge (England) (Assignee).
R. A. E. Wilson.

United States Patent 4,042,506. Issued August 16, 1977. Official Gazette of the United States Patent Office, Vol 961, No 3, p 1277, August, 1977.

Descriptors: *Filtration, *Patents, *Sludge treatment, *Screening, *Equipment, Sewage treatment, Waste water treatment.

A device for separating solid and liquid matter in sewage or other liquids by screening has been patented. The device includes a duct through which sewage flows. Two screens are provided for sewage filtration. A cylindrical screen extends vertically through the duct and is rotatable about its vertical axis. A second vertically extending screen receives solid material from the screen. A lifting plate over the top of the second screen lifts the solid material from the screen to a position above the main sewage flow. The solid material is then removed from the lifting plate to a horizontally extending compression chamber. (Schulz-FIRL)
W77-12947

WASTE WATER TREATMENT METHOD,

Kao Soap Co., Tokyo (Japan). (Assignee).
T. Takeda, Y. Atarashi, and A. Mori.
United States Patent 4,043,904. Issued August 23, 1977. Official Gazette of the United States Patent Office, Vol 961, No 4, p 1747, August, 1977.

Descriptors: *Organic compounds, *Flocculation, *Chemical precipitation, *Salts, *Patents, *Organic wastes, Chemical wastes, Waste water treatment.

Identifiers: Hydrocarbons, Formaldehyde.

A waste water treatment process has been patented which removes formaldehyde-produced water-soluble salts of condensates of sulfonates of mono- or fused poly-cyclic benzenoid aromatic hydrocarbons having from 1 to 12 benzene rings. An inorganic flocculating agent at a concentration of from 50 to 1000 ppm is added to the waste water. The pH is maintained from about 6.5 to 9.5 during the process. Flocs which contain a portion of the condensates are then removed from the waste water. Activated carbon at concentrations of from 50 to 400 ppm is then added to the partially treated waste water. The solution is agitated over a period of time for sufficient absorption of the condensates. The activated carbon is then filtered from the treated waste water. (Schulz-FIRL)
W77-12948

PROCESS FOR PROMOTION OF ALGAE GROWTH IN A SEWAGE MEDIUM, I. Dor.

United States Patent 4,043,903. Issued August 23, 1977. Official Gazette of the United States Patent Office, Vol 961, No 4, p 1747, August, 1977.

Descriptors: *Algae, *Microorganisms, *Patents, *Aquatic algae, *Growth chambers, Dialysis, Membrane processes, Treatment, Sewage, Plant growth.

Identifiers: Algae growth.

A process and apparatus to promote the growth of algae in a sewage medium have been patented. Algae is placed in pure water separated from sewage water by a dialysis membrane which has a porosity of about 250A to 24A. The algae is subjected to light of an intensity of at least 15,000 lux. An osmotic interaction occurs across the membrane as a result of the difference in concentration gradient. (Schulz-FIRL)
W77-12949

REMOVAL OF PHOSPHORUS FROM WASTE WATER,

Allied Colloids Ltd., Bradford (England). (Assignee).

J. R. Field, and K. G. Andrew.

United States Patent 4,043,910. Issued August 23, 1977. Official Gazette of the United States Patent Office, Vol 961, No 4, p 1749, August, 1977.

Descriptors: *Phosphates, *Phosphorus, *Ammonium salts, *Chemical precipitation, *Patents, *Coagulation, Polymers, Polyelectrolytes, Separation techniques, Sewage treatment, Effluents, Industrial wastes, Chemical reactions, Ammonium compounds, Salts, Waste water treatment.

Identifiers: Phosphate removal.

A process for the removal of phosphates from waste water has been patented. The method is applicable to raw sewage, effluents from primary or secondary sedimentation, and food processing wastes. Soluble and colloidal phosphate is precipitated from aqueous waste by the addition of multi-valent metal cation-containing inorganic coagulant. Typical cations which may be used include aluminum, ferrous and ferric iron, and calcium. A cationic polyelectrolyte is then added to the waste after an interval of about 15 seconds to 4 minutes after the addition of the coagulant. The cationic polyelectrolyte is in the form of a quaternary ammonium salt of a copolymer with a molecular weight which yields a viscosity of more than 2000 in centipoise of an aqueous solution at pH 6, 25C, and a polymer solution of 1% by weight. The polymer structure is illustrated. (Schulz-FIRL)
W77-12950

SLUDGE DEWATERING,

C. H. Cox.

United States Patent 4,041,854. Issued August 16, 1977. Official Gazette of the United States Patent Office, Vol. 961, No. 3, p 1065-1066, August, 1977.

Descriptors: *Dewatering, *Patents, *Sludge treatment, *Equipment, *Filtration, *Separation techniques, Design data, Waste water treatment.

Identifiers: Sludge dewatering.

A patented sludge dewatering device includes an outer funnel-shaped cylindrical shell which is equipped with a sludge inlet and a sludge outlet. The filter-dewatering shell diameter is largest at the sludge inlet and narrows toward the sludge outlet. A rotary shaft extending through the filter-dewatering shell is equipped with a screw-like sludge compression blade. A coil-spring blade supported by the main compression blade is provided to scrape sludge from the inner surfaces of the shell. A secondary shaft within the main rotary shaft is mounted and powered so that it rotates in a direction countercurrent to the direction of the main shaft. A filter-cake discharging blade is attached to the outlet end of the secondary shaft. (Schulz-FIRL)

W77-12951

PROCESS OF DEWATERING SEWAGE SLUDGE,Agway, Inc., Syracuse, N.Y. (Assignee).
N. K. Talbert.

United States Patent 4,038,180. Issued July 26, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 4, p 1747, July, 1977.

Descriptors: *Dewatering, *Separation techniques, *Sewage treatment, *Chemical reactions, *Patents, Sludge treatment, Acid-base equilibrium, Salts, Waste water treatment.

A method for dewatering nongaseous sewage sludge has been patented. In the treatment process, sewage sludge with a low enough water content to render it non-compressible is mixed with a mineral acid or anhydride. The water is extracted to form a mixture of sludge solids and water-diluted acid. The mixture is then placed in a reaction vessel with enough base to sufficiently react with the previously added acid or anhydride, and heated to remove the remaining water. The treatment process produces a granular mixture of sludge solids and a salt. (Schulz-FIRL)
W77-12952

PROCESS FOR DEWATERING SEWAGE SLUDGE,Agway, Inc., Syracuse, N.Y. (Assignee).
N. K. Talbert.

United States Patent 4,038,181. Issued July 26, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 4, p 1747, July, 1977.

Descriptors: *Dewatering, *Separation techniques, *Chemical reactions, *Sewage treatment, *Ureas, Salts, Ammonium compounds, Potassium compounds, Sludge treatment, Patents, Waste water treatment.
Identifiers: Chemical dewatering.

A chemical process for dewatering unprocessed sludge containing at least 75% water has been patented. Urea and the common salts of ammonium and potassium are mixed with an equivalent or lesser amount of sludge. After dissolution of the chemicals, the sludge-chemical mixture separates into a liquid phase containing the added chemicals dissolved in water and a solid or semi-solid phase of sludge solids. The two phases can then be physically separated. (Schulz-FIRL)
W77-12953

ANAEROBIC DIGESTION PROCESS,RecTech, Inc., State College, Pa. (Assignee).
J. E. Ort.

United States Patent 4,040,953. Issued August 9, 1977. Official Gazette of the United States Patent Office, Vol. 961, No. 2, p 755, August, 1977.

Descriptors: *Sludge digestion, *Anaerobic digestion, *Patents, *Methane, Sludge treatment, Carbon dioxide, Organic wastes, Digestion tanks, Waste water treatment.

A two-stage anaerobic digestion process for the treatment of organic wastes and the production of gases, including methane and carbon dioxide, has been patented. A liquid slurry of organic wastes is maintained in the digesters for a total retention time of at least 24 hours with an air space above the slurry allowing for a volume-to-interface ratio of at least 100 gallons per square foot. Methane is produced and collected during both stages of anaerobic digestion. After the second stage of digestion is complete, the sludge is transferred to a stripping zone where sludge pH is adjusted to 6.0-6.5 to remove carbon dioxide. After carbon dioxide removal the sludge is recycled to the first digester for further digestion and methane production. (Schulz-FIRL)
W77-12954

SEWAGE SLUDGE-IRRADIATION DEVICE,Brown, Boveri and Co. Ltd., Baden (Switzerland). (Assignee).
U. La Roche.

United States Patent 4,038,028. Issued July 26, 1977. Official Gazette of the United States Patent Office, Vol. 960, No. 4, p 1705, July, 1977.

Descriptors: *Disinfection, *Radiation, *Sludge treatment, *Design data, *Sewage treatment, *Patents, Microorganisms, Irradiation, Waste water treatment.
Identifiers: Sterilization.

An apparatus for the sterilization of sewage sludge by irradiation has been patented. The device contains a conveyor system with at least two separate conveyor belts. Sewage sludge is supplied to at least one of the conveyor belts and spread to form a substantially coherent thin layer on the belt surface. The two conveyor belts are positioned to provide a passageway and mixing gap between them. The irradiating device is positioned so that sludge is subjected to radiation immediately prior to mixing in the interbelt gap. (Schulz-FIRL)
W77-12955

ANAEROBIC WASTE TREATMENT FACILITY,W. A. Garrott, Jr.
United States Patent 4,040,963. Issued August 9, 1977. Official Gazette of the United States Patent Office, Vol. 961, No. 2, p 755, August, 1977.

Descriptors: *Anaerobic digestion, *Sludge digestion, *Patents, *Digestion tanks, *Mixing, Design data, Sludge treatment, Waste water treatment.

An anaerobic digester which contains a mixing zone, a quiescent zone, a clear zone, and an inlet and outlet for the movement of waste water has been patented. The system can prevent the entry of large particles from the quiescent zone into the clear zone, and selectively circulate material between the mixing and clear zones with a rotor below the liquid level in the digester. Rotary circulation is accomplished by a stationary conduit rotor and a second conduit member which is vertically moveable with respect to the first rotor. Vertical motion of the second rotor is limited so that it is also confined below the liquid level in the sludge digester. The digester itself is a flat-bottomed tank with outwardly sloping side walls and a cover. (Schulz-FIRL)
W77-12956

5E. Ultimate Disposal Of Wastes**STORAGE OF TREATED SEWAGE EFFLUENT AND STORM WATER IN A SALINE AQUIFER, PINELLAS PENINSULA, FLORIDA,**Geological Survey, Tampa, Fla. Water Resources Div.
J. S. Rosenzhein, and J. J. Hickey.

Ground Water, Vol. 15, No. 4, p 284-293, July-August 1977. 5 fig, 3 tab, 11 ref.

Descriptors: *Waste disposal, *Injection wells, *Waste water disposal, *Underground storage, *Effluents, Saline water, Aquifers, Test wells, Aquifer characteristics, Water quality control.

The Pinellas Peninsula, an area of 750 square kilometers (290 square miles) in coastal west-central Florida, is a small hydrogeologic replica of Florida. Most of the Peninsula's water supply is imported from well fields as much as 65 kilometers (40 miles) inland. Stresses on the hydrologic environment of the Peninsula and on adjacent water bodies resulting from intensive water-resources development and waste discharge, have resulted in marked interest in subsurface storage of waste water (treated effluent and untreated storm water) and in future retrieval of the stored water for non-potable use. If subsurface storage is approved by

regulatory agencies, as much as 70 million gallons a day of waste water could be stored underground within a few years, and more than 150 million gallons a day could be stored in about 25 years. This storage would constitute a large resource of nearly freshwater in the saline aquifers underlying about 520 square kilometers (200 square miles) of the Peninsula. (Woodard-USGS)
W77-12377

EFFECTS OF TREATED MUNICIPAL WASTE WATER ON GROWTH, FIBER, PROTEIN, AND AMINO ACID CONTENT OF SORGHUM GRAIN,

Arizona Univ., Tucson. Dept. of Plant Sciences.

A. D. Day, and T. C. Tucker.
Journal of Environmental Quality, Vol. 6, No. 3, p 325-327, July-September, 1977. 2 tab, 15 ref.

Descriptors: *Soil-water-plant relationships, *Irrigation practices, *Grain sorghum, *Fertilizers, Plant growth, Soil types, Southwest U.S., Arizona, Grains(Crops), *Waste water disposal, Municipal wastes, Activated sludge, Water supply development, *Water reuse.
Identifiers: Tucson(AZ).

The effect of treated municipal waste water on growth, fiber, protein, and amino acid content of grain from sorghum was investigated in Tucson, Arizona, for grain growth in two soil types. Comoro sandy loam and Grabe silt loam were used in experiments with treated municipal waste water, well irrigation water, and commercial inorganic fertilizer. For grain grown in Comoro sandy loam, average number of days from planting to maturity, leaf length, and grain yield were lower for plots that received well water with appropriate amounts of N, P, and K than for plots irrigated with waste water. Sorghum growth relationships were similar in Grabe silt loam soils, although more tillers were produced per plant with well water than with waste water. Analyses of fiber, protein, and amino acid for sorghum grain grown with different irrigation and fertilizer treatments indicated that total protein contents, leucine, methionine, threonine, and tyrosine were similar for all treatments and soil types. Cystine, glycine, and histidine were lower for grain irrigated with waste water, or with simulated waste water produced by the addition of appropriate amounts of N, P, and K to well water, than for grain grown with simple well water irrigation. Municipal waste water is suggested as an effective source of irrigation water and plant fertilizer to increase yields for grain crops in the southwestern United States. (Schulz-FIRL)
W77-12404

INITIAL DILUTION WITH DEEPWATER DIFFUSERS,Caldwell Connell Engineers, Melbourne (Australia).
I. G. Wallis.

Journal Water Pollution Control Federation, Vol. 49, No. 7, p 1621-1626, July, 1977. 3 fig, 3 tab, 3 ref, 2 append.

Descriptors: *Deep water, *Design criteria, *Discharge(Water), *Waste dilution, Buoyancy, Density, Waste disposal, Currents(Water), Diffusion, Waste water disposal, Effluents, Water Pollution Control Federation, Waste water treatment.
Identifiers: *Deep water diffusers.

The dynamics of ocean-discharged effluent from deep water diffusers are examined in an effort to better predict the thickness, width, location, and strength of the effluent field in relation to diffuser design and other factors. Factors considered include grit and sludge deposition near the outfall, vertical distribution of the effluent, fluctuations in effluent discharge rate, ocean currents, vertical density profiles, and effluent characteristics such as initial dilution and coliform level. The degree of buoyancy, which is determined by the relative

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal Of Wastes

densities of the effluent and seawater, is the major controlling factor in the dilution and motion of the effluent. A series of simulations was carried out to determine the effect of diffuser design on the behavior of the effluent field. Using diffusers with different combinations of port spacing, port diameter, and discharge velocity, it was determined that the effect of initial momentum on dilution was relatively insignificant compared with buoyancy. Initial dilution could be predicted on the basis of unit length discharge of the diffuser and diffuser depth if greater than 40 meters. A diagram relating discharge per unit length, diffusion depth, and initial dilution was presented as a means of elevating diffuser efficiency and design. Various factors which influence the thickness of the surface effluent field are discussed, including: diffuser depth, ocean currents, stratification, vertical mixing, and effluent strength. (Schulz-FIRL) W77-12408

MORE DISPOSAL OPERATIONS MIXING SEWAGE SLUDGE AND MUNICIPAL SOLID WASTES

Environmental Protection Agency, Washington, D.C. Resource Recovery Div.
D. B. Sussman.
Solid Wastes Management, Vol 20, No 8, p 48, 50, 60, August, 1977.

Descriptors: *Incineration, *Sludge disposal, *Dewatering, *Drying, *Fuels, Energy conversion, Waste disposal, Sewage disposal, Solid wastes, Equipment, Municipal wastes, Reviews, Model studies, Waste water treatment.
Identifiers: Multiple hearth furnaces, Fluidized bed combustion, Spray drying, Rotary drying, Furnace drying, Waterwall combustion thin film drying, Waterwall combustion flash drying.

Combination disposal practices in which the energy produced from the combustion of solids is used to dewater municipal sludge are discussed in an EPA update. Basic methods of thermal co-disposal include the use of the organic portion of solids as fuel for sludge incinerators and the use of a solid wastes incinerator, solid wastes fired steam generator, or a waterwall combustion unit to burn dewatered sludge. Approximately 200 waste water treatment plants in the United States utilize thermal processes for sludge disposal. The use of a fluidized bed furnace at Franklin, Ohio is described. An EPA-supported demonstration in Concord, California of the use of a multiple hearth sludge incinerator with refuse-derived fuel (RDF) is described. This incinerator, modified to operate in either incineration or pyrolysis mode, is fed RDF mixed with sludge which has a solids content of 16%. incineration and spray drying at Ansonia, Connecticut produces dried sludge which is used by local residents for fertilizer. Incineration and rotary drying are used to dewater sludge at Holyoke, Massachusetts. Norwalk, Connecticut and Glen Cove, New York use incineration and furnace drying for waste disposal. Waterwall combustion thin film drying at Dieppe, France and waterwall combustion flash drying at Krefeld, Germany are described. Co-disposal of wastes is an energy-saving and possible fuel-producing technique of solid waste and sewage sludge disposal. (Schulz-FIRL) W77-12418

HIGH ENERGY ELECTRON IRRADIATION OF WASTEWATER LIQUID RESIDUALS

Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
For primary bibliographic entry see Field 5D.
W77-12419

CO-DISPOSAL FOR SOLID WASTES AND SEWAGE SLUDGE

Environmental Protection Agency, Washington, D.C. Resource Recovery Div.
D. B. Sussman.
Waste Age, Vol 8, No 7, p 44, 46, 49, July, 1977.

Descriptors: *Incineration, *Sludge disposal, *Dewatering, *Drying, *Fuels, Energy conversion, Waste disposal, Sewage disposal, Solid wastes, Equipment, Municipal wastes, Waste water treatment.

Identifiers: Multiple hearth furnaces, Fluidized bed combustion, Spray drying, Rotary drying, Furnace drying, Waterwall combustion thin film drying, Waterwall combustion flash drying.

Co-disposal of solid wastes and sewage sludge has been suggested as a more efficient means of municipal waste disposal. Basic methods of thermal co-disposal include incineration of sewage sludge using refuse-derived fuel (RDF) and the use of a solid waste incinerator, solid waste fired steam generator, or waterwall combustion unit to dewater sludge. Approximately 200 waste water treatment facilities in the United States utilize thermal sludge disposal, usually with multiple hearth or fluidized bed incinerators. A fluidized bed furnace at Franklin, Ohio is fueled with refuse-derived fuel as a combination of solid waste and sludge. An EPA-supported demonstration at Concord, California of the operation of a multiple hearth incinerator in pyrolysis mode is described. Combustion of pyrolysis gas resulted in sufficient energy for recovery in a waste heat boiler. Solid waste incinerator flue gases have been used in sludge dewatering at a 200 TPD refractory incinerator at Ansonia, Connecticut and a 50 TPD refractory incinerator at Holyoke, Massachusetts. The direct use of heat generated in solid waste combustion to dry and burn sewage sludge has been demonstrated at Norwalk, Connecticut and at Glen Cove, New York. Waterwall combustion thin film drying at Dieppe, France, and waterwall combustion flash drying at Krefeld, Germany, are described. (Schulz-FIRL) W77-12426

WATER QUALITY MANAGEMENT—WASTE DISPOSAL: A WATER AUTHORITY VIEWPOINT

Thames Water Authority, London (England). Conservancy Div.
M. R. Jones.

The Public Health Engineer, Vol 5, No 4, p 100-102, July, 1977. 3 ref.

Descriptors: *Waste disposal, *Landfills, *Environmental engineering, *Geology, *Groundwater, Water pollution control, On-site investigations, Industrial wastes, Municipal wastes, Hydrologic aspects.
Identifiers: Thames Water Authority.

Various aspects of waste disposal in the United Kingdom are discussed and current means of disposal are outlined. Environmental hazards associated with waste disposal in sanitary landfills are described. General guidelines for waste disposal and site choice by the Thames Conservancy Division of the Thames Water Authority are described. Considerations for site choice include geology, groundwater and surficial hydrology, and topography of the area being evaluated. The Thames Conservancy Division discourages the placement of waste disposal sites in areas underlain by chalk and oolitic limestone, and encourages detailed hydrologic surveys prior to any waste disposal. Additional criteria are presented for the disposal of toxic wastes and for the operation of industrial waste treatment plants. (Schulz-FIRL) W77-12428

ACTUATORS FOR EDINBURGH'S NEW SEWAGE DISPOSAL SCHEME

For primary bibliographic entry see Field 5D.
W77-12429

SURVIVAL AND MOVEMENT OF ENTEROVIRUS IN CONNECTION WITH LAND DISPOSAL OF SLUDGES

Statens Forsogestation, Vejen (Denmark).

For primary bibliographic entry see Field 5B.
W77-12434

FLORIDA INSTALLATION DISPERSES EFFLUENTS VIA IRRIGATION SYSTEM

For primary bibliographic entry see Field 5G.
W77-12436

BAY-AREA INDUSTRIES TO RE-USE TREATED WASTEWATER

For primary bibliographic entry see Field 5D.
W77-12437

SINGLE-HEARTH SCREENINGS INCINERATOR

Processing, Vol. 23, No. 7, p 35, July, 1977.

Descriptors: *Incineration, *Sludge disposal, *Dewatering, Equipment, *Screens, Ultimate disposal, Operation and maintenance, Sewage treatment, Design data, Waste water treatment.
Identifiers: Single-hearth screenings incinerators.

Neptune Nichols, in association with Nichols Engineering S. A., has developed a single-hearth incinerator for the disposal of dewatered screenings from sewage pretreatment. Screenings can be processed either in sacks or in loose form and without supervision between loadings. Two models are produced for the incineration of 100 and 200 kg of screenings per day or population equivalents of 100,000 and 200,000, respectively. The internal diameter of the smaller unit is 1.5 m, overall height is 3.25 m, and total weight is 5500 kg. (Schulz-FIRL) W77-12440

POLLUTION CONTROL BY INCINERATION

J. G. M. Thorne.
Processing, Vol. 23, No. 7, p 34-35, July, 1977. 1 fig.

Descriptors: *Incineration, *Sludge disposal, *Dewatering, *Screens, *Gases, Ultimate disposal, Treatment facilities, Equipment, Operation and maintenance, Burning, Oxidation, Organic wastes, Filtration, Monitoring, Waste water treatment.
Identifiers: Fluidized beds, Thermal oxidation, Sludge conditioning, Emission control.

The Dorr-Oliver Company Ltd. has provided a fluidized bed combustion system to the Esher Water Pollution Control Works, Surrey, of the Thames Water Authority-Southern Division for the incineration of sewage sludge. Treatment at Esher includes mechanical screen raking, sedimentation, biological filtration, digestion, microstraining, and sludge incineration. Dorr-Oliver Picket fence thickeners, 8.5 m in diameter and 3.4 m deep, remove supernatant and subnatant water from humus sludge with automatic dewatering cells. Vacuum filtration with two Komline-Sander Colifilters is used for sludge dewatering. Chemically conditioned sludge cakes are fed into the Fluosolids reactor by two Mono sludge pumps. The Dorr-Oliver Fluosolids System contains a windbox, a fluid bed, and a freeboard. Graded sand is air fluidized by a Blackman fluidizing blower to provide proper conditions for thermal oxidation to evaporate water and eliminate organic matter in the sludge cake. Fluidizing air at a temperature of 500C is partially heated by the reactor exit gases. A Venturi scrubber followed by a multi-tray Swemco cooling system is provided for removal of SO₂ and particulates from the exit gases. A TV monitoring system and an oxygen analyzer are used to monitor reactor performance. (Schulz-FIRL) W77-12441

EFFECT OF DRIED ANAEROBICALLY DIGESTED SEWAGE SLUDGE ON YIELD AND

ELEMENT ACCUMULATION IN TALL FESCUE AND ALFALFA,

Southern Illinois Univ. at Carbondale. Dept. of Plant and Soil Science.
D. J. Stucky, and T. S. Newman
Journal of Environmental Quality, Vol. 6, No. 3, p 271-274, July-September, 1977. 5 tab, 13 ref.

Descriptors: *Anaerobic digestion, *Fertilizers, *Alfalfa, *Fescues, *Sludge disposal, Spoil banks, Strip mine wastes, Heavy metals, Soil amendments, Nutrients, Sewage disposal, Soil-plant relationships, Plant growth, Erosion control, Hydrogen ion concentration, Soil treatment, Acidic soils, Waste disposal.

This study was initiated to examine the effect of three application rates of dried anaerobically digested sludge on two different soil media on the establishment, yield, duration, and element accumulation in tall fescue and alfalfa. In a greenhouse study, acid strip-mine spoil and agricultural soil were used to compare plant growth in sewage-amended and untreated media. Sludge was applied at 0, 314, and 627 metric tons/hectare to the agricultural soil control and the strip mine spoil. Plant yields were significantly higher for strip-mine spoil amended with 627 metric tons/ha and for agricultural soil amended with 314 and 627 metric tons/ha. Concentrations of Mn, Ni, Cd, Zn, and Cu were measured in plants and soils. Concentrations of Mn, Zn, Ni, and Cd in tall fescue and alfalfa grown in strip-mine spoils were higher at higher sludge application rates. Sludge application rate did not affect Cu uptake. Concentrations of Mn, Zn, Ni, and Cd in tall fescue were highest during the 180 to 200 day growth period. For alfalfa Mn and Cd peak concentrations occurred during the same period, but Zn, Cu, and Ni uptake decreased with time. The study suggested that plant growth and erosion control in acid strip-mine spoils (pH 3.5) may be accomplished by dried sewage sludge applications of 314 metric tons/ha to a depth of 10 cm. (Schulz-FIRL)
W77-12444

BACTERIAL AND VIRAL PATHOGENS ASSOCIATED WITH LAND APPLICATION OF ORGANIC WASTES,

Washington State Univ., Pullman. Coll. of Agricultural Research Center.
L. F. Elliot, and J. R. Ellis.
Journal of Environmental Quality, Vol. 6, No. 3, p 245-251, July-September, 1977. 1 fig, 1 tab, 57 ref.

Descriptors: *Pathogenic bacteria, *Soil amendments, *Soil-water-plant relationships, *Viruses, *Enteric bacteria, Waste disposal, Aerosols, Sludge disposal, Municipal wastes, Disinfection, Water reuse, Crop production, Fertilizers, Return flow, Sewage disposal, Waste water treatment.

Hazards associated with possible bacterial and viral pathogens present in sewage are considered with respect to land application of organic wastes as a means of sludge disposal. The effects of waste treatment on virus survival and the removal and survival of bacterial pathogens are discussed. Factors which affect bacterial and virus survival in soil are reviewed. Pathogen dispersion by aerosols produced by waste and water treatment by sprinkler irrigation is examined. A number of studies on pathogens present in sewage sludge and on transmission of enteric diseases through waste water irrigation or sludge application for agricultural purposes are referenced. Factors which affect transmission probability of enteric diseases by land-applied wastes are discussed including virulence, quantity, and waste-loading rates. Suggested application practices include restraint in sludge application during the current growing season for root crops and one month before harvest for above-ground crops. Restriction of grazing for 2 to 3 weeks after waste application is also recommended. (Schulz-FIRL)
W77-12445

LAND APPLICATION OF EFFLUENTS IN THE ROCKY MOUNTAIN-PRAIRIE REGION,

Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.

R. J. Dean.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 245, Price codes: A08 in paper copy, A01 in microfiche. Report to EPA Office of Water Program Operations, Washington, D.C., 1974. 152 p, 11 tab, 163 ref, 3 append. (M.S. Thesis).

Descriptors: *Return flow, *Surveys, *Irrigation practices, *Sprinkler irrigation, *Rocky Mountain region, Grasslands, Colorado, Montana, North Dakota, South Dakota, Wyoming, Utah, Soil properties, Vegetation effects, Waste water disposal, Treatment facilities, Soil-water-plant relationships, Waste water treatment.

Results of a survey of land application of waste water effluents in the Rocky Mountain-Prairie Region states of Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming are presented. Areas using spray irrigation, overland flow, and ridge and furrow irrigation were examined. Engineering and technical issues considered include pretreatment requirements, effluent characteristics, site requirements and selection, and the fate of waste water constituents. Parameters controlling site requirements and selection include relative location, topography, geology, climate and evapotranspiration, local geology, loading rates, soil characteristics, groundwater and subsurface drainage, storage facilities, and pilot system performance. Waste water constituents may be dispersed by release to the atmosphere, runoff to surface waters, soil retention, absorption by plants, and leaching to groundwater. The fate and distribution of physical constituents, organics, major inorganic ions, nutrients, trace elements, toxic chemicals, and pathogens are discussed. Results of the survey on land application practices are provided. A copy of the survey questionnaire which elicited information on irrigation methods, crops and ground cover, a system description, site characteristics, legal restrictions and soil characteristics, is presented. (Schulz-FIRL)
W77-12489

DEVELOPMENT AND TESTING OF A WASTE-WATER RECYCLER AND HEATER,

CHEMTRIC Inc., Rosemont, Ill.
For primary bibliographic entry see Field 5D.
W77-12493

ENERGY USES AND RECOVERY IN SLUDGE DISPOSAL, PART 2,

Stanford Research Inst., Menlo Park, Calif.
J. L. Jones, and D. C. Bomberger, Jr.
Water and Sewage Works, Vol 124, No 8, p 42-46, August, 1977. 11 fig, 8 tab, 22 ref.

Descriptors: *Sludge disposal, *Incineration, *Capital costs, *Energy, *Fuels, Sludge treatment, Cost comparisons, Operating costs, Treatment, Waste water treatment, Sewage treatment, Dewatering, Filtration.

Since sludge disposal may represent as much as 25% of total plant operating costs, sludge disposal and treatment processes are examined with respect to costs and energy requirements. The base treatment unit used for comparison includes preliminary treatment, primary clarification and sludge thickening, activated sludge aeration, secondary clarification and sludge thickening, and sludge storage. Five sludge handling options were considered, using vacuum filtration or filter press dewatering in combination with chemical conditioning, high or low pressure wet oxidation, flash drying, sludge digestion, and multiple hearth incineration. Operating and capital costs and energy facilities. At the 10 mgd level, chemical conditioning followed by filter press dewatering and sludge incineration was the least costly sludge handling

option. At the 100 and 500 mgd levels, low pressure wet air oxidation followed by vacuum filtration and sludge incineration was the least costly option. In an overall comparison of energy usage based on electrical and fuel requirements, anaerobic digestion, filter press dewatering plus incineration, and heat treatment with low pressure wet air oxidation plus incineration had the lowest net BTU consumption. Energy usage for each of the sludge handling options was calculated for all three plant sizes. (Schulz-FIRL)
W77-12498

UNIFORM SLURRY SPREADING WITH A CENTER PIVOT IRRIGATION SYSTEM,

Valmont Industries, Inc., Valley, Nebr.
For primary bibliographic entry see Field 5D.
W77-12612

LAND DISPOSAL OF SEWAGE SLUDGE, VOLUME IV (APRIL, 1975 - MARCH, 1976),

Guelph Univ. (Ontario).
T. E. Bates, E. G. Beauchamp, R. A. Johnston, J. W. Ketcheson, and R. Protz.
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 60, 1977. Environmental Protection Service, Environment Canada, Ottawa, Canada. 317 p, 10 fig, 258 tab.

Descriptors: *Sewage disposal, *Surface drainage, *Sludge, Runoff, Soil properties, Drainage water, Drainage effects, *Sewage treatment, Chemical analysis, Chemical degradation, Land use, Landfills, *Waste water disposal.

This report discusses the results from the third year of field runoff studies with fall, winter and spring applications of fluid sewage sludge on land cropped with grain corn. Runoff of water, soil, nutrients and metals were measured. The report also covers field rate and source studies with three sludges resulting from treatment of sewage with calcium hydroxide, ferric chloride, and aluminum sulphate for phosphorus removal. One experiment involves surface sludge applications on a loam soil on which bromegrass is grown, and three trials involve corn on a loam, a sandy loam and a clay loam soil. In one greenhouse experiment, nine fluid sewage sludges, selected for their high metal content, were applied to a soil previously adjusted to two pH levels. Five crops of ryegrass were grown with sludges added to the soils before each crop. Crops growth, and nutrient and metal uptake were studied along with micropedological studies of the soils. The sludges and field grown crops were monitored for pathogenic organisms. Field experiments and laboratory studies were used to estimate the nitrogen availability from sludge and the rates of volatilization of nitrogen from surface applied sludge in the field. A greenhouse experiment was also run on a group of soils varying in metal content. The soils were extracted with various chemicals in an effort to find suitable extractants for plant available cadmium, copper, nickel, lead and zinc. (WATDOC)
W77-12791

OCEAN DUMPING REGULATION: AN OVERVIEW,

For primary bibliographic entry see Field 5G.
W77-12885

THE ENVIRONMENTAL EFFECTS OF DUMPING IN THE OCEANS AND GREAT LAKES,

For primary bibliographic entry see Field 5G.
W77-12899

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 6. ELECTRON IRRADIATION, SEWAGE SLUDGE AND AQUACULTURE,

Massachusetts Inst. of Tech. Cambridge. Marine Industry Advisory Services.
For primary bibliographic entry see Field 5D.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal Of Wastes

W77-12915

BIOLOGICAL TRANSFORMATION PLANT FOR REFUSE AND SLUDGE--WITH PRE-MIXER FOR TREATMENT CHAMBER,
For primary bibliographic entry see Field 5D.
W77-12918

PROCESS FOR SLUDGE DISPOSAL AND CIRCULAR LANDFILL SYSTEM,
Dravo Corp., Pittsburgh, Pa. (Assignee).
J. L. Jordan.

United States Patent 4,016,073. Issued April 5, 1977. Official Gazette of the United States Patent Office, Vol. 957, No. 1, p 266, April, 1977. 1 fig.

Descriptors: *Patents, *Sludge disposal, *Landfills, Soil disposal field, Solid wastes, Evaporation, Aeration, Drying, Waste water treatment, Sludge treatment.

A patent was issued for a disposal process for waste products, including aqueous sludge, in a circular landfill. The circular disposal area has a raised central portion and a dike perimeter. Several disposal ponds are created by radial dikes from the center to the dike perimeter. Aqueous sludge is charged from a central mechanism into the first of the disposal ponds, settled, and the supernatant water is removed from a location near the perimeter dike. The settled solids are dried by evaporation and are mechanically disturbed to aerate added settled sludge solids. Solid absorbent particulate matter is deposited on the partially dried sludge solids and mixed to form a landfill material within the disposal pond. The material is compacted, which raises the level of the perimeter dike and radial dikes, and the process is repeated. (Collins-FIRL)
W77-12920

PROCESS FOR TREATING MUNICIPAL WASTES TO PRODUCE A FUEL,
Guaranty Performance Co., Inc., Independence, Kans. (Assignee).
A. D. Livingston.
United States Patent 4,026,678. Issued May 31, 1977. Official Gazette of the United States Patent Office, Vol. 958, No. 5, p 2083-2084, May, 1977.

Descriptors: *Patents, *Fuels, *Solid wastes, Waste treatment, Municipal wastes, Moisture content, Organic matter, Temperature, Waste disposal, Waste water treatment.

A patent was issued for a process to treat municipal wastes for use in fuel production. Solid wastes, containing organic matter (15% by weight) that could be fiberized, were treated to produce a substantially homogeneous pulp-like mixture. This mixture should have a moisture content of 20-70% by weight. An air-fluidized stream of this mixture, with a temperature of 130-180 F, was then produced. This stream, which contained the fiberized material in a solids fraction, possessed a moisture content that enhanced the organic material's adhesive properties. The fiberized organic material content was maintained at a minimum of 15% by weight. The solids fraction was collected while maintaining its temperature level, and was finally formed into self-sustaining bodies. (Collins-FIRL)
W77-12940

DISPOSAL METHOD AND USE OF SEWAGE SLUDGE,
IU Conversion Systems, Inc., Philadelphia, Pa. (Assignee).
W. C. Webster, R. G. Hilton, and R. F. Cotts.
United States Patent 4,028,130. Issued June 7, 1977. Official Gazette of the United States Patent Office, Vol. 959, No. 1, p 272, June, 1977.

Descriptors: *Patents, *Sludge disposal, Lime, Fly ash, Solid wastes, Moisture content, Drying, Waste disposal, Waste water treatment.

A patent was issued for a sludge disposal method. The sludge was admixed with lime and fly ash. The final composition of the admixture should be: 1-15% lime, 1-50% digested sludge solids, 20-90% fly ash, and 5-50% moisture content. The latter must be based on weight percent of dry solids. The final process step consisted of drying the admixture under atmospheric conditions. (Collins-FIRL)
W77-12941

STATUS OF ALTERNATIVE SYSTEMS FOR SEPTIC WASTES DISPOSAL IN NORTH CAROLINA,

North Carolina State Univ. at Raleigh. Dept. of Soil Science.
B. L. Carlie, L. W. Stewart, and M. D. Sobsey.
Sea Grant Reprint No 108, Reprinted from: Proceedings Second Annual Illinois Private Sewage Disposal Symposium, held at Champaign, Illinois, January 17-19, 1977. 16 p, 3 fig, 3 tab, 7 ref.

Descriptors: *North Carolina, *Waste disposal, *Sewage disposal, *Surface waters, *Groundwater, *Water pollution control, *Hazardous, Coasts, Shellfish.
Identifiers: Septic wastes, Soil resources.

Dye studies indicate that septic tank systems in the study area contribute significant contamination to nearby shellfish harvesting waters via surface and subsurface flow. Surface ponding of septic tank effluent during periods of rainfall constitutes a potential health hazard through possible direct contact with these wastes. Continued dependence on conventional septic tank systems for area waste treatment will result in further degradation of area water resources. Studies such as these and from evidence of vast acres of shellfish waters closed, provide convincing evidence that the 'carrying capacity' or use potential of land sites have already been exceeded in many coastal areas of the state. If septic tanks are indiscriminately installed in the area, then a reasonable estimate is that approximately 90% will not function properly and will fail to some degree within the first year's use. Ultimately, a research goal is to define the carrying capacity of soil types, to identify the basic soil limitations in determining loading intensities for conventional and alternative systems of septic waste disposal which would allow developments to proceed without creating additional pollution loads on surface and ground waters. (NOAA)
W77-12962

STUDY OF MARINE FAUNA FROM ROCKY SUBSTRATES IN THE ZONE OF SEWAGE OUTFALL OF THE CITY OF MARSEILLE (FRANCE), (IN FRENCH),
Ecole Agents Technique Peches, Dakar (Senegal).
For primary bibliographic entry see Field 5C.
W77-12982

5F. Water Treatment and Quality Alteration

PURIFICATION OF NATURAL WATER IN CLARIFIERS WITH SUSPENDED FILTER (OCHISTKA PRIRODNOI VODY V OSVETLITELYAKH SO VZVESHENNYM FIL'TROM),
G. A. Romanov, A. I. Ezerskii, and Yu. M. Smirnov.
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Tselyulozno-Bumazhnoi Promyshlennosti, No. 67, p 182-193, 1975. 3 fig, 1 illus, 5 ref, 2 tab.

Descriptors: *Water purification, Equipment, *Water treatment, *Filtration, Construction, Operation and maintenance, Foreign countries,

Filters, Sludge, Suspended solids, Performance, Construction, Turbidity, Efficiencies, Treatment facilities.

Identifiers: USSR, Clarifiers, Fluidized beds.

The characteristics of natural waters from the viewpoint of quality, the principles of water treatment with coagulants, the determination of the optimum dose of a coagulant, and equipment for the preparation and metering of water-treatment reagents are discussed, and a description is given of the construction, operation, and performance of water clarifiers designed at the All-Union Research Institute of Hydrological and Sanitary Equipment (USSR). These clarifiers are equipped with a perforated bottom for uniform distribution of water and with sludge-thickening trays. They operate on the principle of forced suction, and the filtering layer is in a suspended (fluidized) state. The VNIIGS-1 clarifier is designed for clarification of colored waters of low turbidity (containing up to 300 mg/liter suspended solids), the VNIGS-2 clarifier for turbid waters containing 300-2500 mg/liter suspended solids. Experimental data are presented showing the efficiency of the two clarifiers. (Stapinski-IPC)
W77-12358

POTABLE WATER FROM WASTEWATER--DENVER'S PROGRAM,
For primary bibliographic entry see Field 5D.
W77-12395

DUAL WATER SYSTEMS -- DESIGN,
For primary bibliographic entry see Field 5D.
W77-12402

WANTED: BETTER WAYS TO CLEAN WATER,
For primary bibliographic entry see Field 5D.
W77-12452

DUCTILE IRON PIPES TO CARRY WIMBLEBALL WATER,
For primary bibliographic entry see Field 8G.
W77-12464

THE EFFECTS OF NTA ON THE CHLORINE DEMAND OF VARIOUS TYPES OF WATER,
Environmental Protection Agency, Narragansett, R.I. Northeastern Water Supply Lab.
For primary bibliographic entry see Field 5C.
W77-12480

NEW MICROBIAL INDICATORS OF DISINFECTION EFFICIENCY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W77-12483

CONTINUING NEED FOR IMPROVED OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS.
General Accounting Office, Washington, D.C.
For primary bibliographic entry see Field 5D.
W77-12586

HISTORY, STATUS AND FUTURE OF DISTILLATION PROCESSES,
Watson Desalination Consultants, Manassas, Va.
For primary bibliographic entry see Field 3A.
W77-12631

STATE-OF-THE-ART OF MEMBRANE AND ION EXCHANGE DESALTING PROCESSES,
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 3A.
W77-12632

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration—Group 5F

BROMINE CHLORIDE: AN ALTERNATIVE DISINFECTANT TO CHLORINE,

Hawaii Univ., Honolulu. Water Resources Research Center.

B. H. Keswick, R. S. Fujioka, N. C. Burbank Jr., and P. C. Loh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 023. Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum Report No. 54, May 1977. 15 p, 8 fig, 16 ref. OWRT A-053-HI(1), 14-31-0001-4011.

Descriptors: *Chlorine, Halogens, Viruses, *Disinfection, Water treatment, *Hawaii, Waste water treatment.

Identifiers: *Bromine chloride, Bromamine, Chloramine, Poliovirus, Oahu(Hawaii).

Bromine chloride (BrCl) was evaluated as an alternative to chlorine as a disinfectant of water and waste water by comparing the efficiency of these two chemicals to inactivate type 1 poliovirus seeded in various aqueous solutions. In a nitrogen-free buffer at pH 6.0, the minimum concentration of BrCl required to effectively inactivate poliovirus (4-log reduction after 15 min at 25C) was 0.15 mg/l, whereas 0.3 mg/l of chlorine was required to accomplish the same effect. The virus inactivating efficiency of BrCl was not affected by pH within the range of pH 6 to 10. The addition of various concentrations of glycine and NH₄Cl to the nitrogen-free buffer solutions more effectively interfered with the virus inactivating properties of chlorine than of BrCl. To stimulate waste water disinfection, 1 to 5 mg/l of BrCl and chlorine were added to activated sludge treated sewage effluent seeded with poliovirus, mixed well, and titered after 15 min at 25C. The results show that the inactivating effects of 1, 2, and 3 mg/l dose of both chlorine and BrCl were equivalent and inefficient. However, at a dose of 5 mg/l, BrCl inactivated 5 logs of virus, whereas chlorine inactivated only 2 logs of virus. These results indicate that BrCl should be seriously considered as a potential alternative to chlorine as a disinfectant.
W77-12634

CONTAINERIZED WATER REFINER EXCHANGE SYSTEM,

Water Refining Co., Inc., Middletown, Ohio. (Assignee).

S. H. Davis.
U.S. Patent No 4,009,102, 4 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 955, No 4, p 1263, February 22, 1977.

Descriptors: *Patents, *Water purification, *Water treatment, *Separation techniques, Water softening, Demineralization, Water quality control, Filters, Equipment.
Identifiers: Regeneration.

A water refining system is described in which spent refining material is removed on a batch basis in small portable containers for regeneration of the material at a central processing plant. The spent material is then replaced with new or regenerated material using the same type of portable containers. This provides an exchange type system in which the fixed refiner is of greater size than is usually considered feasible for systems of this type and provides considerable flexibility in selecting the size of the refiner while permitting the use of the same portable containers. The portable containers are formed from a light weight plastic material such as polyethylene and are provided with an opening at one end which is complementary to a discharge outlet from the refiner and a pouring spout at the container opposite end for use in replenishing the supply of refining material. (Sinha-OEIS)
W77-12685

WATER FILTER,

P. Foody.

U.S. Patent No 4,021,339, 6 p, 3 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 283, May 3, 1977.

Descriptors: *Patents, *Water purification, *Water treatment, *Filtration, Separation techniques, Flow, Filters, Equipment.
Identifiers: Backwash.

The filter of the invention is arranged such that the flow of the fluid to be filtered (the in-flow) is in a horizontal plane. The beds of aggregate are backwashed with the flow of backwash fluid being upward substantially normal to the direction of flow in the in-flow. During backwash a filtration bed may be most effectively cleaned if the volume and flow rate of the backwash fluid is such that it fluidizes the bed. In this invention each of the beds is separately confined so that each bed may expand upwardly during backwash. This invention also provides a filter which may use any number of media size combinations. (Sinha-OEIS)
W77-12689

WATER PURIFIER,

T. V. Tyler.

U.S. Patent No 4,021,343, 11 p, 11 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 285, May 3, 1977.

Descriptors: *Patents, *Water purification, *Water treatment, *Water quality, *Reverse osmosis, *Filtration, Separation techniques, Domestic water, Valves, Equipment.

The invention provides a water purifying unit which can be economically manufactured, is very simple to install, requires no electrical wiring, shuts off completely when the reservoir is filled with purified water and is compact so that it will fit beneath the sink or in other restricted and out-of-the-way places. The unit includes a reverse osmosis filter which connects to a storage tank feeding the purified water to the inside of a bladder within the tank. The discharged unpurified water from the reverse osmosis unit is conducted to the tank on the outside of the bladder for forcing the purified water to the purified water outlet. A valve in the unpurified water discharge line controls the flow to the tank outside of the bladder. A drain connection that includes a flow restrictor is located downstream of the valve, allowing the impure water within the tank to be displaced to the drain as the tank is filled with pure water. An inlet valve controls the supply of water to the reverse osmosis filter. Actuation also opens the valve in the impure discharge water line to exert pressure on the exterior of the bladder and force the pure water to the pure water outlet. The inlet valve ultimately closes as a result of a pressure signal when the tank is entirely full of purified water. Automatic filling of the system is thereby accomplished and the inlet valve is controlled entirely by hydraulic pressure. (Sinha-OEIS)
W77-12690

MEMBRANE FILTER SYSTEM,

Fired-Krupp G.m.b.H., Essen (West Germany). (Assignee).

G. Koslowski.
U.S. Patent No 4,021,350, 7 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 287, May 3, 1977.

Descriptors: *Patents, *Water purification, *Water treatment, *Membrane processes, Filtration, Membranes, Equipment.

A membrane filter system is composed of tubular membrane supporting pipes placed in parallel and arranged to conduct a flow of concentrate under pressure, by the provision of a deflection sleeve connecting together the ends of two of the pipes to conduct concentrate between the pipes so that concentrate is deflected as it passes through the sleeve. Such deflection produces forces in the

system parallel to the axes of the pipes. A device connects one pipe end and the sleeve for transmitting such axial forces from the sleeve to each supporting pipe. The invention offers the advantage of improved operational dependability since the number of possible points of malfunction is reduced to a minimum. By absorbing the axial forces in the available membrane supporting pipe it becomes possible to combine a number of pipes into a compact and more economical system. (Sinha-OEIS)
W77-12695

MEMBRANE CARTRIDGE WITH IMPROVED CENTRAL COLLECTION TUBE,

Desalination Systems, Inc., Escondido, Calif. (Assignee).

D. T. Bray.

U.S. Patent No 4,021,351, 6 p, 8 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 288, May 3, 1977.

Descriptors: *Patents, Water purification, *Water treatment, *Membrane processes, Reverse osmosis, Filtration, Separation techniques, Fabrication.
Identifiers: Ultrafiltration.

A spiral wound reverse osmosis or ultrafiltration membrane cartridge has a central collection tube fabricated from interlocking segments. The center segments are perforated and the segment at each end is impermeable. The side edges of the cartridge membrane leaves and the permeate transfer sheet are attached to the central collection tube by circumferential bands of glue located outboard of the juncture of the impermeable end segments with adjacent perforate center segments. Substantial fabrication economies result from injection molding the center segments as identical bodies from a single die; and injection molding the end segments also as identical bodies from a single die. (Sinha-OEIS)
W77-12696

TASTES AND ODORS IN WATER SUPPLIES-A REVIEW,

Illinois State Water Survey, Urbana.

S. D. Lin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 142. Price codes: A04 in paper copy, A01 in microfiche. Circular 127, 1977. 50 p, 1 fig, 16 tab, 256 ref.

Descriptors: *Reviews, *Taste, *Odor, *Potable water, *Water quality, Reservoirs, Lakes, Algae, Algal control, Organic compounds, Inorganic compounds, Analytical techniques, Measurement, Chlorination, Water treatment, Water properties, Documentation, Water supply, *Bibliographies.

A literature review is made to critically compare the reported sources, characteristics, and experiences in the control of tastes and odors in potable water supplies. Sources of tastes and odors are grouped as natural and man-made sources, and the probable relationships between sources are schematically diagrammed. The characteristics of consumer responses are discussed. Various measurement techniques are examined. The control and removal of tastes and odors as practiced for reservoirs and lakes, water treatment units, and distribution systems are reviewed. Theoretical concepts and practical examples of each treatment process are given, and the costs of treatment are noted. The case studies presented will be helpful and the report useful for resource planners, consulting engineers, regulatory agencies, and water utility personnel. (Humphreys-ISWS)
W77-12794

USE OF THE EXPERIMENTAL WATER STABILIZATION STATION AT THE NOVOMYL'SK WATER INTAKE IN ROVNO, (IN RUSSIAN),

Regional Sanitary-Epidemiological Center, Rovno.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

For primary bibliographic entry see Field 8G.
W77-12893

WATER QUALITY RESEARCH.

For primary bibliographic entry see Field 5G.
W77-12900

ELIMINATION OF ENTEROVIRUSES DURING TREATMENT OF DRINKING WATER BY COAGULATION - FLOCCULATION - FILTRATION, (IN FRENCH).

Nancy-1 Univ. (France). Laboratoire d'Hygiene et de Recherche de la Sante Publique.
J.-M. Foliguet, and F. Doncoeur.
Water Res 9(11), p 953-961, 1975.

Descriptors: *Coagulation, *Water treatment, *Enteric bacteria, Potable water, Flocculation, Filtration, *Viruses, Chlorides, Iron compounds.
Identifiers: Picornavirus, Poliovirus, *Ferric chloride.

Ferric chloride was studied as the active agent in coagulation and flocculation, followed by decantation and filtration. The effectiveness of polio I virus removal was 99.83 - 99.9992%. These methods are effective as a preliminary for chlorination or ozonation, but only if the water treated does not contain organic material, which impedes viral elimination. Organic material must be substantially reduced before coagulation and flocculation; this can be achieved by a prechlorination or preozonation.—Copyright 1976, Biological Abstracts, Inc.
W77-12944

5G. Water Quality Control

SULFATE SALINE WATER AND ITS INFLUENCE ON SELECTED AQUATIC VERTEBRATES.

North Dakota State Univ., Fargo. Dept. of Zoology.
For primary bibliographic entry see Field 3C.
W77-12259

OUR SHINING WATERS. A FILM ON LAKE EUTROPHICATION.

Washington State Univ., Pullman. Engineering Extension Service.
For primary bibliographic entry see Field 6B.
W77-12266

VERMONT'S NEEDS IN WATER RESOURCES RESEARCH.

Vermont Univ., Burlington. Water Resources Research Center.
For primary bibliographic entry see Field 6B.
W77-12268

WATER ARID AGRICULTURES: SALINITY AND WATERLOGGING IN THE NEAR-EAST REGION.

Food and Agriculture Organization of the United Nations, Cairo (Egypt). Near East Regional Office.
For primary bibliographic entry see Field 3C.
W77-12291

PROCESSING CHANGES AND CLOSED SYSTEMS DESIGNED FOR MINIMUM EFFLUENT DISCHARGE FROM THE MANUFACTURE OF PAPER PULP

(PROCESSANDRINGAR OCH SLUTNA SYSTEM FOR ATT MINSKA UTSLAPP FRAN TILLVERKNING AV PAPPERSMASSA), IVI Konsult A.B., Stockholm (Sweden).
For primary bibliographic entry see Field 5D.
W77-12361

WATER QUALITY MANAGEMENT—THE MANAGEMENT INFORMATION REQUIREMENT.

K. Guiver.
The Public Health Engineer, Vol. 5, No. 4, p 97-99, July, 1977.

Descriptors: *Sampling, *Monitoring, *Water quality management (Applied), *Water pollution control, *Water sampling, Hydrologic data, Water analysis, Mathematical studies, On-site data collections, On-site tests, Laboratory tests, Waste water treatment.

Water quality management practices in the United Kingdom and methods for obtaining water quality information are discussed. Sampling programs may be instituted to provide general background information on water quality, assess environmental effects of sewage and water treatment facilities, and provide data for input to mathematical models. Specific aspects of sampling examined include location and number of sampling points, sample transport and laboratory handling, sampling frequency, sampling equipment, and the choice of parameters for analysis. Automatic sampling equipment and remote sensors are considered for use in water quality management. Coordination in sampling programs is suggested to enhance water quality data. Precautions in sampling to insure sample integrity and occupational safety are discussed. Accuracy in sample and data analyses is considered necessary to insure reliable and cost-beneficial sampling programs. (Schulz-FIRL)
W77-12394

WATER QUALITY MANAGEMENT IN THE SOVIET UNION.

Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.
D. P. Loucks.
Journal Water Pollution Control Federation, Vol. 49, No. 8, p 1767-1778, August, 1977.

Descriptors: *Water management (Applied), *Water quality control, *Water resources development, *Regulation, *Water policy, Water quality standards, Biochemical oxygen demand, Potable water, Waste water treatment, Water pollution control.

Water quality management practices in the Soviet Union were examined as part of a 1972 U. S. - U. S. S. R. Agreement on Cooperation in the Field of Environmental Protection. The All-Union Scientific Research Institute of Water Protection (VNIIVO) and the basic water law (Principles of Water Legislation of the U. S. S. R. and the Union Republics) govern water quality management in the Soviet Union. Water quality standards are based on three criteria: organoleptic characteristics, damage to the self-purification capacity of the water body, and toxicity to animals or plants. Stream standards and water quality monitoring programs vary with intended water use and only apply to waters where fish are raised or drinking water is drawn. A network of basin inspectorates is used to enforce municipal and industrial effluent standards. Protection of groundwater quality from pollution by industrial effluent lagoon seepage and infiltration is minimal, implemented only where direct contamination of drinking water is possible. Polluted urban runoff waters in the Soviet Union are usually treated in separate or dual treatment systems. Riparian Water Protection Zones in agricultural areas were designated to prevent erosion products from entering surface waters, prevent soil and stream bank erosion, maintain quality of water used for recreation, and prevent contamination from construction or other temporary activities. Multipurpose water quality planning was implemented in the U. S. S. R. at the All-Union level in 1965 with primary emphasis on BOD control. (Schulz-FIRL)
W77-12398

WATER QUALITY MANAGEMENT - QUALITY PLANNING.

Thames Water Authority, London (England) HQ Scientific Services.
P. Casapieri.
The Public Health Engineer, Vol. 5, No. 3, p 76-79, May, 1977. 1 tab, 5 ref, 1 append.

Descriptors: *Water quality, *Rivers, *Water pollution control, *Classification, Water utilization, Water quality standards, Effluents, Water management (Applied).

Identifiers: *River classification systems, Thames River (UK).

An historical background for water quality standards in the United Kingdom is presented as part of a general overview on river quality classification as a means of controlling effluent discharge. A new river classification system is compared with a 1969 version prepared by the Department of the Environment. The new system includes subdivisions based on quality criteria such as dissolved oxygen, ammonia, biochemical oxygen demand, potability, and toxicity to fish. Additional guidelines and potential uses are given for each subdivision. In order to maintain membership in a particular class, a given stream may not exceed class-limiting criteria more than 5% of the time. The levels of the river classification system also provided target levels for stream quality improvement. (Schulz-FIRL)
W77-12401

INITIAL DILUTION WITH DEEPWATER DIFFUSERS.

Caldwell Connell Engineers, Melbourne (Australia).
For primary bibliographic entry see Field 5E.
W77-12408

THE TECHNICAL-ECONOMIC MODEL OF WATER QUALITY IN THE SAJO RIVER (A SAJO VIZMINOSEGI MUSZAKI-KOZGAZ-SAJAGI MODELLJE).

Karl Marx Univ. of Economics, Budapest (Hungary).
G. Bora, B. Hock, G. Mucsy, J. Pinter, and G. Reczey.
Hidrologiai Kozlony, Vol. 57, No. 1, p 27-37, January, 1977. 3 fig, 9 tab, 36 ref.

Descriptors: *Water quality standards, *Model studies, *Chemical oxygen demand, *Water pollution control, Treatment facilities, Industrial wastes, Water pollution sources, Planning, Rivers, Economics, Costs, *Waste water treatment.
Identifiers: Hungary (Sajo River).

A technical-economic model was developed as an aid in planning construction of sewage treatment facilities for the Sajo River area of Hungary. COD, characterized by dichromate oxygen consumption, was used as the basis for modelling oxidizable substances. The effluent discharge to the river was mainly toxic industrial wastes. It was assumed that the decrease of the COD mass current in the direction of flow was proportionate to the existing COD. Nine major streams represented 98% of the COD mass current. These were considered in the model formulation. The model set COD standards for the receiving waters to aid optimization of construction and operating costs. Alternative technologies were developed for individual pollution sources and related costs were computed. Allowances were made for future industrial development. The final choices were determined by the achievement of COD standards at the lowest cost. (Collins-FIRL)
W77-12413

SELECTIVE RENOVATION OF EUTROPHIC WASTES PHOSPHATE/SULPHATE EXCHANGE.

Istituto di Ricerche sulle Acque, Bari (Italy).
For primary bibliographic entry see Field 5D.

W77-12422

WATER QUALITY MANAGEMENT--WASTE DISPOSAL: A WATER AUTHORITY VIEW-POINT.

Thames Water Authority, London (England). Conservancy Div.

For primary bibliographic entry see Field 5E. W77-12428

ADVANCED SEWAGE TREATMENT FAILS COST-ENVIRONMENTAL BENEFIT TEST.

Engineering News Record, Vol. 199, No. 8, p. 13, August, 1977.

Descriptors: *Cost-benefit analysis, *Costs, *Water quality standards, *Federal Water Pollution Act, Treatment facilities, Texas, Effluents, Biochemical oxygen demand, Suspended solids, Water quality, Water pollution control, Sewage treatment, Waste water treatment.

Identifiers: Texas Water Quality Board, Dallas(TX), Fort Worth(TX).

The Texas Water Quality Board has recently relaxed its advanced waste water treatment standards from 5-3-3 standards (5 ppm BOD, 5 ppm suspended solids, and 3 ppm ammonia) to requirements of 10 ppm BOD and 15 ppm suspended solids. The reduction in standards for the Mesquite plant near Dallas, Texas was in response to a permit for a proposed \$12.5-million expansion and upgrading of the regional waste water facility. Costs for upgrading five Dallas/Fort Worth area waste water treatment plants to the new standards are estimated at \$100 million, as opposed to the estimated \$600 million necessary to upgrade all the facilities to the 5-5-3 standards. Because the five treatment plants discharge effluent into the Trinity River, which during dry weather is 98% effluent, plant operators considered the actual reduction in pollutant loads resulting from adherence to the stricter standards to be insignificant. The strict 5-5-3 standards were initially imposed by the Texas Water Quality Board in an effort to meet requirements of the Federal Water Pollution Control Act Amendments of 1972. (Schulz-FIRL)

W77-12431

FLORIDA INSTALLATION DISPERSES EFFLUENTS VIA IRRIGATION SYSTEM.

Civil Engineering, Vol. 47, No. 8, p. 16, August, 1977.

Descriptors: *Treatment facilities, *Sprinkler irrigation, *Waste water disposal, *Irrigation practices, *Return flow, Hay, Forages, Field crops, Effluents, Waste water treatment, Irrigation systems, Municipal wastes, Industrial wastes.

Identifiers: Winter Haven(FL).

A waste water treatment facility in Winter Haven, Florida, has been constructed by Valmont Industries Incorporated of Valley, Nebraska. Treated effluent from the Winter Haven plant flows by gravity to a 31-acre holding pond and is pumped to nine spray units which irrigate a total of 630 acres of hay forage crops. Each spray unit in the Valmont system in use at Winter Haven includes nine center pivots and seven drive units which irrigate a total of 70 acres each. Biological treatment at the Winter Haven plant removes at least 95% of the biochemical oxygen demand and suspended solids. Spray irrigation of approximately 1,500 acres will be used to remove all the remaining organics and nutrients. The Valmont system has been applied elsewhere for municipal wastes and for a variety of industrial wastes from food, chemical and livestock processors. (Schulz-FIRL)

W77-12436

EPA SETS RULES ON 'INELIGIBLE' SEWERS.

The American City and County, Vol. 92, No. 8, p. 13, August, 1977.

Descriptors: *Sewerage, *Septic tanks, *Legislation, *Sewage treatment, *Cost-benefit analysis, Construction, Sewers, Environmental sanitation, Waste water treatment.

The U. S. Environmental Protection Agency has limited the availability of construction funds for sewage collection systems, restricting grants to application where the lack of such system has serious public health implications and other methods of sewage collection and treatment are not as cost-effective. Population density criteria established in 1972 limit the allocation of EPA funds for sewage system construction to areas with a population density of more than 1.7 persons per acre. Current EPA grant application regulations require the applicant to demonstrate that a collection system in more cost-effective than septic tanks, holding tanks, 'honey wagons', or aerated mounds for areas where the population density is less than 10 persons per acre. (Schulz-FIRL)

W77-12460

EASING THE BURDEN ON TREATMENT WORKS.

Effluent and Water Treatment Journal, Vol. 17, No. 6, p. 275, June, 1977.

Descriptors: *Treatment facilities, *Sewerage, *Anaerobic conditions, *Aerobic treatment, *Sewers, Aerobic bacteria, Sewage treatment, Pipes, Oxygenation, Aeration, Waste water treatment.

Identifiers: Wessex Water Authority(UK), Bath(UK), Saltford(UK), Water Research Center(UK).

Extension of sewage treatment plant facilities by modification of sewer mains has been considered by the Water Research Center, Wessex Water Authority, and British Oxygen Company, Ltd., in the United Kingdom. A large-scale application of the principle is being tested for a five-mile stretch of pumping main between Bath and Saltford. In this section, sewage became anaerobic and more difficult to treat at the already overloaded treatment plant. An oxygen injection system was used to establish aerobic conditions in the sewer main, allowing aerobic bacteria to partially digest sewage before it arrives at the sewage treatment plant. (Schulz-FIRL)

W77-12461

HOW TO CONDUCT A WASTEWATER SURVEY, PART I - IDENTIFYING PHYSICAL CHARACTERISTICS OF SEWER SYSTEMS.

Burns and Roe Industrial Services Corp., Paramus, N.J.
A. S. Vernick.
Plant Engineering, Vol. 31, No. 14, p. 85-87, July, 1977. 5 fig.

Descriptors: *Waste water treatment, *Surveys, *Waste treatment, *Sewerage, *Facilities, Waste water(Pollution), Storm drains, Drainage systems, Management, On-site investigations, Basic data collections, Water quality control.

A method for conduction a waste water survey is outlined as an important aspect in developing more efficient waste water management programs. This part of a two part series emphasizes identification of the physical characteristics of sewer systems. The first part of the survey would entail the compilation and review of a complete drawing file of all plans and schematic diagrams that related to the plant's sewer systems and water supply. Observations should be made on the plant's sanitary sewage system, storm water collection and disposal facilities, and process drainage systems. The next part of the survey would require field investigation to confirm and augment information provided by the drawing file. Specific objectives would include: the characterization of plant design, layout, and waste sources, sampling point selection; and familiarization with sewer, collec-

tion, and disposal systems. A complete identification of the physical characteristics of a sewer system aids in the preparation of updated sewer maps, flow diagrams, and individual waste stream profiles. (Schulz-FIRL)

W77-12465

SCIENTIFIC AND TECHNICAL EVALUATION OF THE ENVIRONMENTAL PROTECTION AGENCY'S WASTEWATER FACILITIES PLANNING, BOSTON CASE STUDY, PHASE I: WATER QUALITY CONSIDERATIONS.

Resource Analysis Inc., Cambridge, Mass.
R. Noss, T. Najarian, and D. H. Marks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 582. Price codes: A14 in paper copy, A01 in microfiche. Final Report to Council on Environmental Quality, Washington, DC, 1976. 324 p, 52 fig, 23 tab, 8 append.

Descriptors: *Treatment facilities, *Federal Water Pollution Control Act, *Planning, *Massachusetts, Water management(Applied), Water quality, Water pollution sources, Treatment facilities, River basins, Harbors, Regional planning, Legal aspects, Construction, Regulation, Waste water treatment.

Identifiers: *Boston(MA), Boston Harbor, Charles River, Mystic River, Neponset River, Sudbury River, Assabet River, Concord River, North River, Construction grants.

The Boston area was chosen for an investigation into planning effectiveness for municipal treatment facilities construction grants under the Federal Water Pollution Control Act Amendments of 1972. The two-phase study will ultimately include data collection in the initial phase of the study and data evaluation in the second phase. Data collections included analyses of existing waste sources and water quality in the basins of Boston Harbor, Charles River, Mystic River, Neponset River, Sudbury-Assabet-Concord Rivers, and North River. Current plans and priorities for construction of waste water facilities by surrounding municipalities are discussed. Major issues and reviews of cost effectiveness of decisions to improve water quality are examined for each basin in the study area. Appendices include descriptions of water quality standards, classifications, and segmentation as well as the results of qualitative and quantitative water analyses conducted for each of the basins. (Schulz-FIRL)

W77-12472

ROLE OF MODELS IN URBAN STORMWATER MANAGEMENT PLANNING.

Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. P. Heaney.

In: Applications of Stormwater Management Models - 1976, Report EPA-600/2-77-065, 1977. p. 4-13, 1 fig, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Computer models, *Mathematical models, *Federal Water Pollution Control Act, Water management(Applied), Urban runoff, Storm runoff, Storm water, Planning, Management, *Waste water treatment.

Identifiers: Storm water management.

An outline is presented which examines possible uses for mathematical models or simulations in storm water management, in compliance with Section 208 of the Federal Water Pollution Control Act Amendments which require plans to abate and control point and non-point waste sources in urban areas. Areas evaluated for model use in Section 208 implementation include: public participation and local government involvement; organization; data collection; natural and physical systems analysis; social, economic, and land use analysis; waste water source analysis; waste water treatment systems, nonpoint sources, and water quality

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Group 5G—Water Quality Control

analysis; groundwater protection and enhancement; development of non-point source control strategies; land use/water quality relationship; public works/water quality relationship; and institutional analysis. The report also considered waste water management techniques; evaluation and comparison of alternative plans; selection of waste treatment management program; environmental, social, and economic impact assessment; plan preparation and completion; and coordination activities. Specific models suggested for use include STORM, FILTH, and the Universal Soil Loss Equation (USLE). (Schulz-FIRL) W77-12491

THE USE OF BACTERIA TO REDUCE CLOGGING OF SEWER LINES BY GREASE IN MUNICIPAL SEWAGE. Maryland-National Capital Park and Planning Commission, Silver Spring. N. Baig, and E. M. Grenning. In: *Biological Control of Water Pollution* (ed. Tourbier, J., and Pierson, R. W. Jr.), University of Pennsylvania Press, 1976. p 245-252, 4 tab, 5 ref.

Descriptors: *Biological treatment, *Bacteria, *Cultures, *Sewerage, *Sewers, Manholes, Organic wastes, Decomposing organic matter, Maintenance costs, Treatment, Cleaning, Sewage bacteria, Sewage treatment, Municipal wastes, Microbial degradation, Drainage systems, Waste water treatment.

Identifiers: *Sewer maintenance, Degreasers, Perry (FL), St George County (MD), Montgomery County (MD).

An alternative to traditional cleaning and removal of grease from sewers by mechanical means is described. Packaged freeze-dried bacteria cultures are reactivated in water and added to sewer mains and laterals through manhole covers. Accumulated grease is consumed and organic material, removed from the sewer walls, flows to the treatment plant. After initial grease deposits are removed, low-dosage applications are used to prevent further accumulation. The use of bacteria cultures for removal is suggested as a much less costly alternative to mechanical cleaning. Cost projections for sewer cleaning in Montgomery and St. George's Counties, Maryland were placed at \$4 million for traditional cleaning methods and \$1.3 million for bacterial treatment. Bacterial cultures may also provide pretreatment of sewage as it flows through the collection system. Information municipalities currently using bacterial cleaning is given, including population size, providing organization, system characteristics, and user experiences. (See also W77-11690) (Schulz-FIRL) W77-12492

COUNTERMEASURES FOR POLLUTION FROM OVERFLOWS; THE STATE OF THE ART.

Municipal Environmental Research Lab., Edison, N.J. Storm and Combined Sewer Section. R. Field, and J. A. Lager. Available from the National Technical Information Service, Springfield, VA 22161 as PB-240 498, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-670/2-74-090, December 1974. 38 p, 4 fig, 2 tab, 28 ref.

Descriptors: *Urban runoff, *Storm water, *Combined sewers, *Overflow, *Storm drains, Storage tanks, Hydraulics, Mathematical models, Reviews, Sewage treatment, Water pollution control, Costs, Cost comparisons, Waste water treatment, Water management (Applied). Identifiers: Storm water management.

A state-of-the-art review of treatment and control of storm water runoff and combined sewer overflow is presented. Management alternatives including source controls, collection system controls, storage, and treatment are discussed. Methods of abatement for urban runoff include re-

tention, physical treatment, biological treatment, physical-chemical treatment, disinfection, and integrated processes. Storage costs and cost comparisons for different treatment alternatives are provided for various cities in the United States. Legislation which supports the development of countermeasures against the environmental impacts of urban runoff is examined, including the Federal Water Pollution Control Act (FWPCA), 1972 amendments to the FWPCA, and state and local requirements. Considerations in characterizing and evaluating storm water include simulation models, nationwide assessment of urban runoff impacts, combined sewage sludge, uniform procedures for analysis and evaluation of storm flow characteristics and treatability, flow measurement, consideration of trace pollutants, and pathogen detection. Methods of storm water treatment discussed include new sewer design, upstream impoundment, catch basins, runoff attenuation by porous pavement, dual use facilities, swirl and helical separators, and screening devices. (See also W75-07692) (Schulz-FIRL) W77-12497

MANAGEMENT FOR OPTIMUM EFFICIENCY. Texas A and M Univ., College Station. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 3F. W77-12510

DEMONSTRATION OF COAL MINE HAUL ROAD SEDIMENT CONTROL TECHNIQUES. Mayes, Sudderth and Etheredge, Inc., Lexington, K.Y. W. F. Grier, C. F. Miller, and J. D. Womack. Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 304, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-76-196, August 1976. 82 p, 11 fig, 8 tab, 19 ref. EPA S-802682.

Descriptors: *Drainage, *Access routes, *Coal mines, *Erosion control, *Kentucky, *Appalachian Mountain Region, Sedimentation, Instrumentation, Data collections, Mining. Identifiers: *Surface mining, *Haul roads.

This Report examined the feasibility of demonstrating the most effective methods of controlling erosion which results when land is disturbed or altered by the construction of access roads to coal mining operations in the steeply sloping areas of Appalachia. The methods of controlling erosion on haul roads utilize techniques that can be reasonably and economically constructed by conventional equipment that is normally used or is available to coal operators. A method to collect qualitative data, by remote instrumentation, for evaluation of the effectiveness of the erosion control methods also was described. (Bhowmik-ISWS) W77-12559

REPORT ON STATE SEDIMENT CONTROL INSTITUTES PROGRAM. Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards. Available from the National Technical Information Service, Springfield, VA 22161 as PB-241 088, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-440/9-75-001, April 1975. 26 p, 1 tab, 2 ref, 2 append.

Descriptors: *Sediment control, *Legal aspects, *Legislation, Erosion, Soil erosion, Sedimentation, Conferences, State governments, Soil conservation, Water pollution control, Sediment transport, Sedimentology.

A series of 40 state sediment control conferences was held to increase awareness of the problem of controlling erosion and sediment runoff, to report on mandatory programs in this field that are in operation or under consideration, to explain the

provisions of a Model Act for Soil Erosion and Sediment Control, and to encourage needed legislative and administrative action to deal with the problem. The conference succeeded in achieving enhanced recognition of the problem of sediment—the nation's most prevalent pollutant in terms of volume—and wider acceptance of the need for accelerated and extended action by officials of conservation districts and a wide variety of local, state, and federal agencies and private organizations. The Institutes were influential in the enactment of several new state laws establishing regulatory programs, in the drafting of 15 new laws for introduction in state legislatures, and the modification of several other pending drafts of proposed state legislation. A model state act for erosion and sediment control was included in an appendix. (Sims-ISWS) W77-12565

ENVIRONMENTAL MANAGEMENT AND REGIONAL ECONOMIC DEVELOPMENT. West Virginia Univ., Morgantown. Regional Research Inst. W. H. Miernyk.

Available from the National Technical Information Service, Springfield, VA 22161 as COM-75-11073, Price codes: A02 in paper copy, A01 in microfiche. Report EDA-OER-75-020, November 6, 1971, 22 p, 5 tab. EDA-OER-411-G-72-9.

Descriptors: *Dynamic programming, *Coal mines, *Air pollution, Environmental effects, Economic impacts, Input-output analysis, Leontief models, Analytical techniques, Economics, Employment, Systems analysis, Regional analysis. Identifiers: Regional pollution coefficients.

This is a preliminary report on a long range investigation of the tradeoffs between environmental management and regional economic development. The analytical tool being used is a dynamic regional input-output model. The full study will take into account all types of pollution, but it is being conducted in a series of discrete phases. The first phase deals with surface coal mining and the second phase is concerned with the abatement of air pollution. In phase 2 a regional variant of Leontief's augmented input-output model with built in pollution-related activities is being used. For this purpose, regional pollution coefficients will be grafted onto the West Virginia dynamic regional model. Leontief's pollution augmented model is of the static-open variety. The West Virginia model is a dynamic variant which includes expansion and replacement capital coefficients. The complete system also includes tables of labor coefficients. Thus, in addition to showing the direct and indirect effects of pollution abatement on output, the solution of the West Virginia model will show the effects on employment, and on expansion and replacement investment. When the air pollution phase of the study has been completed, the same procedure will be repeated for the abatement of water pollution. (Nessa-NC) W77-12583

UPPER SUWANNEE RIVER: EVALUATION OF A PROPOSED DRI AS AN AREA OF CRITICAL STATE CONCERN.

Florida Dept. of Administration, Tallahassee. Div. of State Planning. For primary bibliographic entry see Field 6G. W77-12584

NORTHERN GREAT PLAINS RESOURCES PROGRAM: WATER QUALITY SUBGROUP REPORT.

Northern Great Plains Resources Program, Denver, Colo. For primary bibliographic entry see Field 5C. W77-12588

DEVELOPMENT OF A PROCEDURE FOR FORECASTING LONG RANGE ENVIRONMENTAL IMPACTS, REPORT TO THE RESOURCE AND LAND INVESTIGATIONS PROGRAM (RALD),
Stanford Univ., Calif. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 6G.
W77-12589

SOCIOECONOMIC ASPECTS OF DREDGED MATERIAL DISPOSAL: THE CREATION OF RECREATIONAL LAND IN URBAN AREAS,
Virginia Univ., Charlottesville.
S. S. Skjei.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A029 972. Price codes: A14 in paper copy, A01 in microfiche. Contract Report D-76-6, to Army Engineer Waterways Experiment Station, Vicksburg, Miss. May 1976, 297 p, 26 fig, 10 tab, 2 append. DACW39-74-C-0072.

Descriptors: *Dredging, *Recreational facilities, *Recreation demand, *Social aspects, *Economic impact, Artificial beaches, Cities, Economics, Environmental effects, Legal aspects, Institutional constraints, Water resources development.
Identifiers: *Dredged material disposal, Dredge spoil.

This study is a part of the Corps of Engineers' Dredged Material Research Program (DMRP). The major findings of the study are: (1) dredged material can be used in an economically efficient manner to create recreational land in urban areas; the existing need for recreational facilities, the increasing amount of leisure time available, and changing attitudes suggest that the benefits from the recreational use of dredged material disposal sites can be substantial; (2) environmental concerns are not a insurmountable barrier to the creation of recreational land from dredged material; (3) lack of financial resources available to local communities to develop the recreational potential of disposal sites may be a very important constraint; (4) the attitude toward the idea taken by the Corps of Engineers Districts will often determine the extent to which it is implemented; and (5) some communities will not be able to benefit from the idea, and not all Districts will be able to implement the idea to the same extent. The factors which would constrain the creation of shoreline or offshore recreational land from dredged material are analyzed. The legal, disposal sites are presented and evaluated. A strategy is advanced for coordinating the dredged material disposal activities of Districts with the recreational needs of urban areas. (Nessa-NC)
W77-12590

NUTRIENT MOVEMENT IN STREAMFLOW FROM AGRICULTURAL WATERSHEDS IN THE GEORGIA COASTAL PLAIN,
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
W77-12610

CONCEPTS IN THE CONTROL OF NONPOINT WATER POLLUTION,
Agricultural Research Service, Chickasha, Okla.
For primary bibliographic entry see Field 5B.
W77-12611

NONPOINT SOURCES: STATE-OF-THE-ART OVERVIEW,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
J. M. Sweeten, and D. L. Reddell.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 40 p, 4 fig, 4 tab, 62 ref.

Descriptors: Pollutants, *Pollution abatement, Sediments, Nutrients, Pesticides, Sediment transport, *Reviews, Bibliographies, *Water pollution sources, Water pollution control.
Identifiers: *Nonpoint pollution sources.

The state-of-the-art in nonpoint source pollution abatement was reviewed and found to be quite good. A considerable volume of research has been published in the last three decades on singular aspects of what has lately become known as nonpoint source pollution. This basic and applied research has dealt with such classical soil and water conservation topics as erosion control, sediment transport, soil chemistry and physics, crop production, range management, agricultural chemicals, animal science and forestry. The challenge before agricultural engineers today is to work aggressively with agricultural scientists of other disciplines to locate, interpret, adapt and compile this knowledge into forms that can be useful to Section 208 of Public Law 92-500 area-wide water quality management planners with non-technical and/or nonagricultural backgrounds. Fulfillment of this urgent task may constitute the greatest single agricultural engineering contribution of this decade. (Skogerboe-Colorado State)
W77-12614

RESOURCE ADEQUACY IN LIMITING NON-POINT POLLUTION,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 5B.
W77-12615

THE IMPACT OF ENERGY DEVELOPMENT ON WATER RESOURCES IN THE UPPER COLORADO RIVER BASIN,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3E.
W77-12630

ACID MINE DRAINAGE, A BIBLIOGRAPHY WITH ABSTRACTS.
National Technical Information Service, Springfield, Va.
Available from the National Technical Information Service, Springfield, VA 22161 as NTIS/PS-76/0816. Price codes: E12 in paper copy, E12 in microfiche. National Technical Information Service, NTIS/PS-76/0816, p 1-184, 1976. 184 abstracts. Edited by R. J. Brown.

Descriptors: *Acid water, *Mine acids, *Mine drainage, *Mine wastes, *Acid mine water, *Drainage, *Drainage effects, Water pollution sources, Path of pollutants, Water pollution, Mine water, Wastes, Water quality, Drainage areas, Drainage systems, *Bibliographies.

This bibliography on acid mine drainage cites studies primarily concerning control and treatment methods. Also included are reports on hydrogeology, ecology, formation, and sources. (This updated bibliography contains 184 abstracts, 34 of which are new entries to the previous addition). (Katz)
W77-12664

BURIED WELL SEALS: A NEW METHOD OF RECONSTRUCTION,
Environmental Protection Agency, Washington, D.C. Div. of Water Supply.
W. J. Whitsell, and J. S. Schmidt.
Water Well Journal, Vol. 31, No. 9, p 47-50, September, 1977. 2 fig.

Descriptors: *Water wells, *Well casings, *Joints(Connections), *Sealants, Cements, Damages, Steel pipes.
Identifiers: *Buried well seals.

Buried well casings and seals that require excavation for pump repair or disinfection frequently involve considerable expense to maintain, and can pose grave contamination threats. Although well seals are buried to prevent problems of freezing or farm equipment running into exposed casing, the practice of burying actually creates more difficulty than it solves. Common methods of elevating casing have many deficiencies as well. Welding a section of pipe on top of the old casing is difficult due to cramped working conditions, and a bad weld can provide an avenue for pollutants. Threading the old casing requires equipment that is not readily available, while 'Dresser' type clamp connections yield too easily to lateral and pull-apart forces. Extending casing by using cement joints appears to be one of the simplest, most sanitary and most effective techniques. Laboratory tests at Bucknell University showed that cement joints constructed under simulated field conditions showed more than adequate strength under lateral and axial loads. The cement joint method is not recommended for plastic well casings. (Eberle-NWWA)
W77-12665

OIL PICK UP DEVICE,
British Petroleum Co., Ltd., London (England). (Assignee).
M. G. Webb.
U.S. Patent No 4,021,344, 7 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 1, p 285, May 3, 1977.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water pollution treatment, *Water pollution control, Equipment, Floating.
Identifiers: Oil pick-up device.

A device for removing oil floating on the surface of water comprises a plurality of discs rotatably mounted on bearings which are positioned along different radii of a median circle. The device is supported on floats so that the discs are partly immersed in the water. There are scrapers attached to each disc so that, on rotation of the discs the scrapers remove any liquid adhering to the disc. The means to rotate the discs consist of teeth cut in the circumference of the discs which engage with a worm ring which is mounted with its center coaxial with the center of the median circle. When the worm ring is rotated, the worm teeth engage with the teeth of the disc and thereby drive each disc round on its bearings. The use of a hydraulic motor enables the power source to be remote from the pick-up device. The discs have a smooth surface and are flat. They can be made of any sufficiently rigid material inert to water and sea-water. The scrapers are of oil resistant rubber or plastic strips fixed in contact with the discs. The scrapers are positioned so that when liquid is removed by the scrapers it is fed into a channel and thereby led away. When the device floats on the surface of water, the planes of rotation of the discs are substantially perpendicular to the water surface. (Sinha-OEIS)
W77-12691

OIL-WATER SEPARATION APPARATUS,
Hydronautics, Inc., Laurel, Md. (Assignee).
D. H. Fruman.
U.S. Patent No 4,022,694, 6 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 958, no 2, p 740, May 10, 1977.

Descriptors: *Patents, *Oil pollution, *Oily water, *Water pollution treatment, *Separation techniques, Water pollution, Water pollution sources, Filtration.
Identifiers: Regeneration.

An oil-water separation apparatus has a flow-through separation chamber containing a block of porous material regenerable by compression and a pair of perforated plates located on either side of the block, at least one of which responds to ap-

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plied pressure to compress the material, by providing an envelope of flexible, impervious material completely surrounding the outer surface of the foam block between the block and the inside walls of the chamber. The envelope is connected at either end to the plates so that the foam material and envelope can be readily replaced when necessary. The invention successfully avoids channeling in the flow of feed water through the apparatus but permits the foam block to readily compress and expand within the chamber during regeneration without interfering with the side walls of the chamber. (Sinha-OEIS)
W77-12702

APPARATUS FOR CLARIFICATION OF WASTE WATER OPERATING ON DISSOLVED AIR FLOTATION PROCESS.
For primary bibliographic entry see Field 5D.
W77-12703

PICK-UP ELEMENT FOR OILY CONTAMINANTS.
C. H. Yocum.
U.S. Patent No 3,904,528, 4 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 938, No 2, p 769, September 9, 1975.

Descriptors: *Patents, Oil pollution, *Water pollution control, *Water quality control, *Oil spills, Absorption, Oily water.
Identifiers: Small spills.

An element for picking up oily contaminant in liquid form from the surface of a body of water comprises an outer container of porous material which is pervious to oily contaminants and impervious to water. An absorber filling the container is a spongy material which will absorb oily contaminants. The container has large spaced parallel surfaces in order to float on the water, and contains slits in the direction of the thickness of it. The slits extend from one end edge of the absorber to just short of the other end edge. Granules of absorbent material are sprinkled over the surfaces of the absorber in order to start the absorbent process. The elements can be strung together to form a small boom. (Sinha-OEIS)
W77-12707

METHOD OF REMOVING OIL FROM WATER USING RICE HULLS.
Standard Oil Co. (Ohio), Cleveland. (Assignee).
L. E. Bertram.
U.S. Patent No 3,902,998, 3 p, 2 ref; Official Gazette of the United States Patent Office, Vol 938, No 1, p 268, September 2, 1975.

Descriptors: *Patents, *Water pollution control, Oil pollution, *Oil spills, Oily water, Separation techniques, Absorption, Skimming.
Identifiers: Rice hulls.

A method for removing oil or oily substances contaminating water comprises contacting the water with rice hulls derived from rice processing without any further treatment such as chemical coating on the surface. The rice hulls containing the oil or oily substances are separated from the water by skimming, or by removing the water from below the layer of rice hulls containing oil or oily substances. Another method for removing oil or oily substances contaminating water is to pass the water through a bed of rice hulls. (Sinha-OEIS)
W77-12708

SIGNIFICANCE OF WATER QUALITY TO WATER RESOURCES.
Colorado River Board of California, Los Angeles.
V. E. Valentine.
Presented at the National Water Resources and Ocean Engineering Convention of the American Society of Civil Engineers, April 5-8, 1976, San Diego, California, 13 p, 1 tab, 4 ref. Preprint 2673. \$1.00.

Descriptors: Water quality, *Dissolved solids, Saline water, Economics, Water resources, *Water quality control, *Salinity, Salts.

Of the parameters of water quality, the dissolved solids or salinity parameter requires special attention by water resources planners as it cannot be controlled by filtration or biological reduction processes. As salinity levels in a water supply rise, users of that supply are subject to detrimental effects that impose substantial costs on the users. With the increased recognition of these detrimental effects and their costs in recent years, conflicts have arisen between the groups of users causing salinity increases and those experiencing their impacts. To resolve these conflicts, special public works projects have been and are continuing to be constructed, changes costly in both water and money have been and are continuing to be made in the operation of water resource projects, and private investment plans are restructured at increased costs. (Skogerboe-Colorado State)
W77-12714

A NOTE ON THE USE OF ECONOMIC INCENTIVES IN WATER POLLUTION ABATEMENT.
Technical Univ. of Denmark, Lyngby. Dept. of Chemical Engineering Economics.
M. Bundgaard-Nielsen.
Water Resources Bulletin, Vol 12, No 4, p 755-758, August 1976. 1 fig, 1 tab, 6 ref.

Descriptors: Management, Economics, Taxes, Water pollution, *Water pollution control, *Pollution abatement, *Alternative costs, *Pollution taxes (Charges), Treatment facilities.
Identifiers: Economic incentives, Subsidies.

The firm's decision to invest in wastewater treatment facilities is influenced by the economic incentives provided. The timing of investments in pollution control may be described by an extended version of the first year benefit criterion. The criterion developed may help to provide a better insight into the complex interaction of the various economic incentives used in pollution abatement. (Skogerboe-Colorado State)
W77-12718

STOCHASTIC APPROACH TO THE COLORADO RIVER BASIN.
Bureau of Reclamation, Denver, Colo. Water Utilization Branch.
For primary bibliographic entry see Field 4D.
W77-12724

SYSTEM FOR MANAGING SALINE AND RUN-OFF WATER FOR FRUIT AND CROP PRODUCTION IN ARID REGIONS OF MEXICO.
Food and Agriculture Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 3C.
W77-12741

YIELDS AND ACREAGE AS VARIABLES IN PLANNING THE USE OF SALINE IRRIGATION WATER: A CASE STUDY FROM IRAN.
Technische Universitaet, Brunswick (West Germany). Leichtweiss Inst. for Water Research.
For primary bibliographic entry see Field 3C.
W77-12742

WATER QUALITY AND RETURN FLOW STUDY OF THE OAHU UNIT, SOUTH DAKOTA.
Bureau of Reclamation, Denver, Colo. Colorado River Water Quality Office.
J. W. Keys, III.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 109-126. 3 fig, 2 tab, 6 ref.

Descriptors: Water quality, *Return flow, *South Dakota, *Simulation analysis, Seepage, Dissolved solids, *Water quality control.
Identifiers: Oahu Inlet (S Dak).

The Oahu Unit of the Pick-Sloan Missouri Basin Program will provide Missouri River water for the irrigation of 190,000 acres of land in the James River valley of South Dakota. Computer simulation studies of the operation of the Unit were conducted to estimate the quantity, quality, and timing of irrigation return flows and determine their effects on the James River. This analysis included detailed investigations of the irrigation water and lands to be irrigated, the major elements of return flow (deep percolation, canal seepage, and operational wastes), augmentation releases of water to the James River, natural flow of the river, and operation of project features for storage and regulation of water for irrigation of the Unit. Under natural conditions, total dissolved solids (TDS) levels of James River streamflow are relatively high, averaging about 786 mg/l at Huron. Study results show that TDS levels of the river could be maintained below 1,000 mg/l (current South Dakota water quality standard for the river reach immediately below the project) during the irrigation season, but concentrations during the winter season would frequently exceed that level. Streamflow would be stabilized, however, eliminating very low and highly concentrated flows. (See also W77-12726) (Skogerboe-Colorado State)
W77-12750

VARIOUS INDICES FOR EVALUATING THE EFFECTIVE SALINITY AND SODICITY OF IRRIGATION WATERS.
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 3C.
W77-12752

WATER QUALITY FOR AGRICULTURE.
California Univ., Davis. Dept. of Land, Air, and Water Resources.
R. S. Ayers, and D. W. Westcot.
In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976, p 400-431, 4 tab, 73 ref.

Descriptors: *Water quality, Agriculture, *Crop production, *Salinity, Soil water, *Saline soils, Saline water, Leaching, Sodium, Water supply.

Salinity is discussed from the standpoint of a reduction in soil water availability to crop. Updated crop tolerance tables for salinity of soil or of applied water are presented. The newer leaching requirement concept if achievable represents a considerable water saving as compared to the older LR procedures. Soil permeability problems are associated with waters having either exceptionally low salinity or high sodium. Excessive sodium is evaluated through a modification of the sodium adsorption ratio (SAR), now termed 'adjusted SAR'. Specific ion toxicities are related to the effects of boron, sodium or chloride on sensitive crops. A few other effects are listed under 'miscellaneous problems'. This paper is intended to provide guidance for project managers, farm operators, and general agriculturalists on problems related to on-farm water management and should be useful in placing water quality effects in perspective with the other factors affecting crop production, the ultimate goal being maximum production per unit of available water supply. (See also W77-12726) (Skogerboe-Colorado State)
W77-12753

MINIMIZING THE SALT BURDEN OF PECOS RIVER IRRIGATION DRAINAGE WATER.
New Mexico State Univ., University Park. Dept. of Agronomy.
G. A. O'Connor, and C. Cull.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976. p 494-505, 9 fig, 2 tab, 5 ref.

Descriptors: Leaching, *New Mexico, Lysimeters, Irrigation, *Irrigation effects, Evaporation, Water surface, Return flow, Drainage, *Drainage effects.

Identifiers: *Pecos River(N Mex).

A laboratory study was conducted to evaluate the potential of the minimized leaching concept using synthesized Pecos River water on a New Mexico soil. Nine small lysimeters were repeatedly irrigated at LF's of 0.1, 0.2, and 0.4 and exposed to very high evaporative demands in an evaporation chamber especially designed for the study. Results to date (after 50 irrigations) confirm that minimized leaching results in considerable irrigation water savings and a simultaneous reduction in drainage volume. Even after prolonged irrigation, steady-state conditions have been reached in only the 0.4 LF treatment implying that changes in salt distribution as a result of instituting the minimized leaching program are very slow to occur. (See also W77-12726) (Skogerboe-Colorado State) W77-12754

FATE OF SALTS FROM WATER AND MANURE IN A 4-YEAR FIELD EXPERIMENT, CALIFORNIA UNIV., RIVERSIDE. Dept. of Soil Science and Agricultural Engineering. P. F. Pratt, S. Davis, D. C. Adriano, S. E. Bishop, and A. E. Laag.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976. p 264-276. 3 fig, 5 tab, 9 ref.

Descriptors: Calcium, Magnesium, Sodium, Potassium, *Drainage water, *Farm wastes, Irrigation water, *Return flow, Leaching, *Salts.

The removal of Ca, Mg, Na and K in harvested crops and in drainage waters was measured for a 4-year experiment with animal manures. For each cation the amount added in irrigation water and in manures minus removals in crops and by leaching was assumed to have accumulated in the root zone of the soil. Calcium, Mg and K accumulated in the root zone whereas there was a net loss of Na. The dominant cation in the percolating water was Na, followed by Ca and then by Mg. Very little K was removed by leaching. The dominant anion in the percolating water was Cl. The determined increase in carbonate, expressed as CaCO_3 , in the soil was correlated with the calculated Ca accumulation in the root zone. The calculated Ca accumulated as octacalcium phosphate assuming that all of the fixed P converted to this form, was about 40% of the total Ca accumulation in the root zone. Accumulation of soluble salts in the root zone accounted for only about 6% of the total cation accumulation and there was no increase in CEC. Thus, the main mechanism for cation accumulation was precipitation or fixation. (See also W77-12726) (Skogerboe-Colorado State) W77-12755

DETAILED RETURN FLOW SALINITY AND NUTRIENT SIMULATION MODEL, Bureau of Reclamation, Denver, Colo. M. J. Shaffer.

In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976. p 127-141. 8 fig, 18 ref.

Descriptors: Model studies, *Simulation analysis, Drainage, Nitrogen, *Nutrients, *Return flow, Water quality, Lysimeters, Irrigation effects, *Salinity.

A computer model allows the simultaneous consideration of many complex chemical and physical processes in the unsaturated and saturated zones. The model simulates one-dimensional unsaturated flow and two-dimensional saturated flow (to tile

drains), as well as chemical reactions and transport processes involving the major cations and anions, and nitrogenous species. The program also includes crop uptake of water and nutrients. A numerical integration technique is utilized to solve the appropriate differential equations, and generate transient predictions throughout the soil-aquifer system, and at the drains. Utilization of a master site technique allows application of the model to predict irrigation return flow quality and quantity from large irrigated areas involving thousands of acres. Verification has been accomplished on large acreages as well as field plots, lysimeters, and laboratory columns. The model has a well-documented user's manual and has been applied to several large irrigation projects. (Skogerboe-Colorado State) W77-12757

A CONCEPTUAL HYDROSALINITY MODEL FOR PREDICTING SALT LOAD IN IRRIGATION RETURN FLOWS, California Univ., Davis. Water Science and Engineering Section. For primary bibliographic entry see Field 5B. W77-12758

HYDROSALINITY MODELING OF IRRIGATION RETURN FLOW IN THE MESILLA VALLEY, NEW MEXICO, New Mexico Inst. of Mining and Technology, Socorro. For primary bibliographic entry see Field 5B. W77-12759

INTEGRATING DESALINATION AND AGRICULTURAL SALINITY CONTROL TECHNOLOGIES, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 3A. W77-12761

DESALINIZATION OF A HIGHLY SALINE SOIL, PREDICTION AND FIELD OBSERVATION, Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use. For primary bibliographic entry see Field 3A. W77-12762

ON-FARM WATER MANAGEMENT PRACTICES FOR ALLEVIATING WATERLOGGING AND SALINITY PROBLEMS IN PAKISTAN, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. G. V. Skogerboe. In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976. p 537-557, 2 fig, 2 tab, 19 ref.

Descriptors: Irrigation, Irrigation effects, *Irrigation practices, *Salinity, Saline soils, Saline water, Seepage, Irrigation efficiency, Basins, *Saturated soils. Identifiers: *Pakistan.

A modern irrigation conveyance system was constructed in Pakistan during the past 100 years. There are about 38,000 miles of canals and 100,000 tubewells which command a gross area of over 33 million acres of fertile soils. This probably constitutes the greatest single agricultural potential in the world. However, this modern system ends at the canal outlet, or 'mogha'. The conveyance of irrigation water from the mogha to the fields is accomplished by unlined watercourses operated and maintained by the farmers with little or no governmental assistance. Previous reports have stated that the conveyance efficiencies of these watercourses are high and that high irrigation application efficiencies can be expected for the basin irrigation method commonly used in the Indus

Basin. Recent data have shown watercourse seepage losses to be a significant portion of the water supply, and irrigation application efficiencies are frequently low. Thus, there is a real need for watercourse improvements to save seepage losses and provide better water control in order to achieve higher irrigation application efficiencies. Such improvements would significantly alleviate waterlogging and salinity problems which are a real menace to much of the land. (See also W77-12726) (Skogerboe-Colorado State) W77-12763

EVALUATING IMPROVED IRRIGATION WATER MANAGEMENT TECHNOLOGIES FOR REDUCING SALT PICKUP FROM GRAND VALLEY, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. G. V. Skogerboe, W. R. Walker, R. G. Evans, and S. W. Smith. In: Proceedings of the International Salinity Conference, Texas Tech University, Lubbock, Texas, August 16-20, 1976. p 506-536, 9 fig, 5 tab, 13 ref.

Descriptors: Salinity, *Saline soils, Saline water, *Irrigation water, *Salts, Colorado, Colorado River, *Colorado River Basin, Return flow, Irrigation, Irrigation effects, Irrigation practices, Economics. Identifiers: Irrigation scheduling.

The problem of increasing salinity levels in the lower stem of the Colorado River has been receiving major attention in recent years because of detriments to both agricultural and urban water users in Southern California and the Republic of Mexico. The Grand Valley in Western Colorado has been identified as a major source of salinity, which is the result of subsurface irrigation return flows which take salts into solution during transport through soils and underlying shales of marine origin. A research program was undertaken in September, 1968, to evaluate appropriate technologies which would reduce subsurface return flows and consequently salt pickup. Canal and lateral lining, irrigation scheduling, improved irrigation methods and practices, and drainage have been evaluated in the field for effectiveness as salinity control measures. Hydrosalinity and soil chemistry modeling are being used to evaluate effectiveness. Cost-effectiveness curves are being developed for each appropriate technology and combinations of technologies. An optimization format will be used to arrive at the least cost combination for achieving a desired level of salinity control. This analysis will detail the optimal strategy for implementing various levels of individual salinity control measures into a comprehensive technology package. (See also W77-12726) (Skogerboe-Colorado State) W77-12764

MEAT AND POULTRY PRODUCTS PLANT LIQUID EFFLUENT REGULATIONS AND GUIDELINES, Environment Protection Service, Ottawa (Ontario). Regulations, Codes and Protocols Report EPS 1-WP-77-2, July, 1977. 48 p, 9 append. (In English and French).

Descriptors: Industrial plants, Industrial production, *Industrial wastes, *Liquid wastes, *Poultry, Effluents, Waste water disposal, Regulation, Control systems, Controlled drainage, Governments. Identifiers: Deleterious substances, *Meat products plants, *Poultry products plants.

Regulations and guidelines established by the Fisheries Act in March, 1977, regarding the liquid effluent of meat and poultry plants, are presented. Explanatory notes for these regulations and guidelines are also included in the document. (WATDOC) W77-12774

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STORM WATER MANAGEMENT MODEL STUDY, VOLUME III, USER'S MANUAL. Proctor and Redfern Ltd., Toronto (Ontario); and MacLaren (James F.) Ltd., Toronto (Ontario). For primary bibliographic entry see Field 5B. W77-12792

HYDROLOGIC STUDY OF ILLINOIS BEACH STATE PARK. Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 2A. W77-12793

HEAD GRADIENT CONTROL IN AQUIFERS USED FOR FLUID STORAGE. Auburn Univ., Ala. Dept. of Civil Engineering. For primary bibliographic entry see Field 4B. W77-12800

EROSION AND SEDIMENT CONTROL AUDIOVISUAL TRAINING PROGRAM, INSTRUCTOR'S MANUAL. Hittman Associates, Inc., Environmental and Geosciences Dept. T. R. Mills, M. A. Nawrocki, G. R. Squire, H. T. Hopkins, and M. L. Clar. Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 901. Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/8-76-001a, June 1976. 85 p.

Descriptors: *Erosion control, *Erosion, *Sediment control, *Education, Hydrology, Sedimentation, Training, Publications, Construction.

A series of technical presentations and certification plan for erosion and sediment control specialists were presented. Thirteen lessons, complete with visual aids, student handouts, and audiovisual handouts consisting of slides, videotape and tape narration; workbooks; and instructor's manuals were developed. These materials were designed to provide an effective education program for qualifying construction personnel and others to pass a certification examination. The list of the lessons is as follows: (1) Goals, Objectives and Principles of Erosion and Sediment Control; (2) Soils; (3) Rainfall-Runoff Relationships; (4) Erosion and Sedimentation; (5) Plant Materials; (6) Control of Runoff During Construction; (7) Vegetative Soil Stabilization; (8) Stream Erosion Control; (9) Temporary Soil Stabilization; (10) Control of Sediment Generated on Construction Sites; (11) Erosion and Sediment Control Planning; (12) Wooded Site Development; and (13) Foreman-Inspector Responsibilities. (Lee-ISWS) W77-12815

MISSOURI RIVER MAIN STEM RESERVOIR REGULATION STUDIES. Northern Great Plains Resources Program. Denver, Colo. For primary bibliographic entry see Field 4A. W77-12819

DETENTION TANK FOR COMBINED SEWER OVERFLOW, MILWAUKEE, WISCONSIN, DEMONSTRATION PROJECT. Milwaukee Dept. of Public Works, Wis.; and Consoer, Townsend and Associates, Chicago, Ill. For primary bibliographic entry see Field 5D. W77-12824

CRITERIA DOCUMENT FOR PCB'S. Massachusetts Audubon Society, Lincoln. For primary bibliographic entry see Field 5A. W77-12882

OCEAN DUMPING REGULATION: AN OVERVIEW. J. A. Lumsdaine.

Ecology Law Quarterly, Vol 5, No 4, p 753-92, 1976.

Descriptors: *Oceans, *Waste disposal, *Water pollution control, *Permits, Regulation, Sludge disposal, Economic impact, Administrative agencies, Federal government, Waste water disposal, Pollution abatement, Water pollution sources, Water pollution, Marine animals, Marine plants, Toxins, International waters, Legal aspects, Water permits. Identifiers: *Marine protection, Research and Sanctuaries Act, *Ocean dumping, Environmental Protection Agency, Corps of Engineers, Administrative regulations, Hazardous substances(Pollution), Licenses, Marine resources, Marine environment.

The ocean has been preferred disposal site for dredged spoils, toxic pollutants, industrial wastes and municipal sewage sludge. As a result, extensive damage has been done to marine life as well as to the aesthetic value of the ocean. Laws have been passed to control ocean dumping but all have proved ineffective as no agency is charged with comprehensive regulation. Therefore, Congress enacted the Marine Protection, Research and Sanctuaries Act which regulates, as much as possible, all disposal of wastes into ocean waters and strictly limits any dumping which already affects human health, the marine environment or economic potentialities. The Act operates by requiring permits for any dumping within twelve miles of the United States and for the transportation of materials from the United States for the purpose of ocean dumping. Permits are obtainable from the Environmental Protection Agency (EPA) for the dumping of all materials except dredged spoils, which are controlled by the Army Corps of Engineers. The author feels that a major weakness of the Act is the provision for joint EPA-Corps administration which militates against a comprehensive and coordinated attack on marine pollution. (Moorhouse-Florida) W77-12885

ANIMAL FEEDING FACTORIES AND THE ENVIRONMENT: A SUMMARY OF FEEDLOT POLLUTION, FEDERAL CONTROLS, AND OKLAHOMA LAW. P. M. Recker. Southwestern Law Journal, Vol 30, No 3, p 556-84, Summer 1976.

Descriptors: *Oklahoma, *Water pollution, *Storm runoff, *Feedlots, *Odor, Farm wastes, Air pollution, Federal Water Pollution Control Act, Cattle, Confinement pens, Livestock, Water pollution sources, Water pollution effects, Water pollution control, Water quality, Water quality control, Permits, State governments, Federal government. Identifiers: *Nuisance(Legal aspects), *Environmental Protection Agency, *National Pollutant Discharge Elimination System, Effluent limitations, Administrative regulations, Citizen suits.

Animal feedlots represent the largest single source of solid wastes generated in the nation. Consequently, such feedlots create potential pollution sources. The major problems associated with animal feedlots concern odor and water pollution. Odor pollution is controlled by state laws emanating from provisions of the Federal Clean Air Act of 1967 and by private suits for nuisance which provide the most effective remedy. Feedlots generate water pollution when rainfall runoff comes into contact with manure and carries oxygen-demanding materials and disease organisms into surface waters. State and federal statutes provide the most effective means of controlling water pollution. Almost all fifty states have enacted water quality standards which limit waste discharge into public waters. Feedlots are subject to these controls. The major beef-feeding states have specific feedlot regulations. The Oklahoma

feedlot regulation statute operates through a registration and licensing system. Complying feedlots are considered not to be a nuisance. The Federal Water Pollution Control Act specifically includes feedlots as a point source within the National Pollutant Discharge Elimination System. Consequently the Environmental Protection Agency has published effluent limitation standards applicable to waste discharges of feedlots. (Moorhouse-Florida) W77-12888

DREDGED MATERIAL RESEARCH PROBLEMS AND PROGRESS. Texas Univ. at Dallas, Richardson. For primary bibliographic entry see Field 6E. W77-12892

WASTE OIL STUDY (PRELIMINARY REPORT TO THE CONGRESS). Environmental Protection Agency, Washington, D.C. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 332. Price codes: A04 in paper copy, A01 in microfiche. April 1973. 26 ref.

Descriptors: *Oil pollution, *Secondary recovery(Oil), *Oil wastes, *Environmental effects, Oil, Oil industry, Water pollution, Water pollution sources, Oil spills, Chemical wastes, Industrial wastes, Ecology, Administrative agencies, Waste disposal, Water pollution effects, Wildlife, Water fowl. Identifiers: *Oil waste disposal, *Federal Water Pollution Control Act Amendments of 1972, Environmental policy, Hazardous substances(Pollution).

The Federal Water Pollution Control Act Amendments of 1972 required that within six months after the enactment of the Amendments the Administrator of the Environmental Protection Agency deliver to Congress a preliminary report on the problem of the disposal of waste oils and their effect on the environment. Due to the limited time available for preparation of the report, and the relative lack of existing data at the time of the report, long-term ecological effects were not included. The report deals with the quantities of waste oil generated in the United States and its routes of entry into the environment; the present methods of collection and disposal; the short-term biological effects of waste oil; and the economic and legal aspects of a waste oil policy. Topics for further study are identified, and a framework for research established, based on a number of working principles, which include studying waste oil disposal as a component of a total environmental policy; changing the mix of environmental disposal modes; studying the effects of federal regulations such as depletion allowances which discourage waste oil recovery operations; and forcing those who create the problem to bear the cost of reducing environmental damage. (Sloan-Florida) W77-12897

THE ENVIRONMENTAL EFFECTS OF DUMPING IN THE OCEANS AND GREAT LAKES. Hearings—Subcomm on the Environment and Atmosphere—Comm on Science and Technology, US H Rep, September 17-26, 1975. Serial No 94-55. 876 p.

Descriptors: *Oceans, *Water pollution sources, *Water pollution effects, *Waste disposal, Municipal wastes, Industrial wastes, Sewage sludge, Wastes, Water pollution, Local governments, Federal government, Dredging, Fishkill, Waste dumps, Administrative agencies, Solid wastes, Waste dilution, Ultimate disposal, Solubility. Identifiers: *Ocean dumping, *Congressional hearings, National Oceanic and Atmospheric Administration, Environmental policy, Corps of En-

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gineers, Environmental Protection Agency, Marine ecosystem, Marine environment, Vessels.

Hearings were held before the House Subcommittee on the Environment and the Atmosphere to consider the environmental effects of ocean dumping, a process whereby waste materials are transported and disposed of in the ocean. Testimony was given by federal, state and local officials as well as qualified private individuals. The statements offered provided a general overview of the ocean dumping problem, and a discussion of the particular waste materials dumped including sewage sludge, dredged material, and industrial wastes. Although many witnesses expressed the need for more in-depth study concerning ocean dumping, statistical data presented showed definite harm to marine life and the ocean's recreational qualities. The major concern over a cessation to ocean dumping was lack of a viable alternative. Appendices to the record contain additional material and statements and a response by the Environmental Protection Agency (EPA) to questions submitted subsequent to the hearings. Detailed reports on ocean dumping were filed by the EPA, the National Oceanic and Atmospheric Administration, the Council on Environmental Quality and the Corps of Engineers. (Moorhouse-Florida)
W77-12899

WATER QUALITY RESEARCH.

Hearings—Subcomm on the Environment and Atmosphere—Comm on Science and Technology, US H Rep, September 28-30, October 1, 1976, Serial No 94-106. 945 p.

Descriptors: *Pollution abatement, *Research and development, *Costs, *Technology, Economic impact, Economics, Grants, Model studies, Planning, Research facilities, Testing, Water pollution control, Water pollution sources, Federal government, Local government, Municipal wastes, Industrial wastes, Sewage, Water quality, Waste water treatment.
Identifiers: *Congressional hearings, *Federal Water Pollution Control Act Amendments of 1972, Environmental policy.

Hearings were held before the House Subcommittee on the Environment and the Atmosphere to explore various aspects of water quality research connected with the Federal Water Pollution Control Act Amendments of 1972. Testimony was presented by numerous federal, state and local officials as well as interested private parties, representatives of industry, and members of the academic community. The hearings centered around the effectiveness of water quality research in terms of the practical utilization of its results when measured against expenditures in the billions of dollars. The details of current pollution abatement projects and their economic justifications were included. Additionally, numerous proposed projects and germinating ideas concerning future pollution abatement were introduced. The report document also contains a wealth of detailed scientific and statistical data covering myriad areas of pollution abatement research and development. (Moorhouse-Florida)
W77-12900

IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT (REVIEW OF THE SOUTHWEST SEWER DISTRICT, SUFFOLK COUNTY, LONG ISLAND, NEW YORK).

Hearings—Subcomm on Investigations and Review—Comm of Public Works, US House of Representatives, September 24, 1976, Serial No 94-71. 172 p.

Descriptors: *Sewage districts, *Waste water disposal, *Construction costs, *Federal Water Pollution Control Act, Project planning, Saline water intrusion, Groundwater, Infla-

tion (Economic), Environmental effects, Feasibility, Planning, Water policy, Shellfish, Commercial fishing, Legislation, Water pollution.
Identifiers: *Congressional hearings, Environmental policy.

The endless frustrations associated with the development of the Southwest Sewer District of Suffolk County, New York caused the Subcommittee on Investigations and Review of the House Committee on Public Works and Transportation to launch an investigation. Testimony was taken from environmentalists, members of the US House of Representatives, Suffolk County legislators, and various other state and federal agencies. Among the problems discussed were the sewer system's escalating costs, delays in construction, faulty construction, cost-saving alternatives to the present plan, and the increasing amount of pollution caused by the delay in construction. Included in the information presented were charts showing the city's water cycle, and the area of Long Island Sound closed to shellfishing. In addition, statistical evidence was presented concerning the number of water main and service leaks caused by sewer construction. A comprehensive report of the project prepared by the Environmental Protection Agency in April of 1975 was submitted. Many of the witnesses offered recommendations and solutions for the problems of the sewer system. (Stadler-Florida)
W77-12903

RECENT TANKER ACCIDENTS (HEARINGS, PART I).

Hearings—Comm on Commerce, US Senate, January 11-12, 1977, Serial No 95-4. 497 p.

Descriptors: *Oil spills, *Oil pollution, *Oil industry, Ships, *Coast guard regulations, Water pollution sources, Disasters, Oil, International waters, Transportation, Navigation, Coasts, Seaworthiness, Administrative agencies, Jurisdiction, Regulation, Legislation, International law, Law of the sea, Cost-benefit ratio.
Identifiers: *Tankers, *Very Large Crude Carriers (VLCCs), *Vessels, *Vessel Traffic System, Shipping, Coast Guard, Vessel pollution, Trans-Alaska Pipeline System, Supertankers, Congressional hearings, Coastal waters.

Despite efforts of the United States to reduce dependence on imported oil, more oil was imported in 1976 than previous years. A concurrent increase in accidents involving oil-carrying vessels resulted. The Senate Commerce Committee held hearings early in 1977 to discuss the problems of collisions, groundings, and other tanker accidents which cause traumatic oil spills. The major difficulty encountered in attempt to reduce the number of accidents is that 95% of all oil imported into the United States is carried in foreign flag vessels; the construction, crew training, and manning of these vessels is outside United States jurisdiction. One possible solution would be to impose stringent standards on the construction of any vessel allowed to enter a United States Port. Increased use of Vessel Traffic Systems would also reduce the frequency of collisions. The imposition on vessel operators of strict liability for spills would result in greater precautions taken by the operators, but the oil industry apparently lobbies against the passage of legislation to this effect. Testimony heard includes that of representatives of the Coast Guard, the Maritime Administration, environmental groups, maritime unions, and several members of Congress. (Sloan-Florida)
W77-12904

AMERICAN PAPER INSTITUTE V TRAIN (CHALLENGE TO EFFLUENT LIMITATION GUIDELINES FOR PULP, PAPER AND PAPERBOARD INDUSTRY).

For primary bibliographic entry see Field 6E.
W77-12905

COASTAL WATERWAY ACT OF 1975.

For primary bibliographic entry see Field 6E.
W77-12907

PROHIBITION AGAINST POLLUTION.

For primary bibliographic entry see Field 6E.
W77-12908

TEXAS WATER QUALITY ACT (ESTABLISHMENT OF WATER QUALITY BOARD).

For primary bibliographic entry see Field 6E.
W77-12909

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 6. ELECTRON IRRADIATION, SEWAGE SLUDGE AND AQUACULTURE.

Massachusetts Inst. of Tech. Cambridge. Marine Industry Advisory Services.
For primary bibliographic entry see Field 5D.
W77-12915

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 9. OIL SPILLS: PROBLEMS AND OPPORTUNITIES.

Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
Sea Grant Program Report No. MITSG-77-17, Index No. 77-117-Zvn, July 20, 1977. 27 p, 3 fig, 5 ref.

Descriptors: *Oil spills, *Water pollution, *Pollution abatement, Resources development, Equipment, Water pollution sources.
Identifiers: ARGO MERCHANT, Containment, Containment equipment.

The events occurring during the grounding and break up of the Liberian tanker, ARGO MERCHANT, in December 1976, are used to illustrate the types and magnitudes of problems involved in responding to accidental oil spills. The ARGO MERCHANT incident provides a framework for understanding what is needed for dealing with such events in the future. A chronology of the important events between the grounding and the break up are presented. The need for instrumentation and research to answer the question of 'how much oil has been spilled and where it is likely to go' is dealt with. The equipment and vehicles needed for containment of a spill on the high seas are discussed and then the logistical requirements of getting people and equipment to the spill, containing and collecting oil and removing it are discussed and finally the general characteristics required for two boats and barges are summarized. (NOAA)
W77-12917

STATE OF CALIFORNIA COASTAL MANAGEMENT PROGRAM AND FINAL ENVIRONMENTAL IMPACT STATEMENT.

National Oceanic and Atmospheric Administration, Washington, D.C. Office of Coastal Zone Management.; and California Coastal Zone Conservation Commissions, San Francisco.
For primary bibliographic entry see Field 2L.
W77-12959

ENVIRONMENTAL IMPACT ON PROPERTY VALUES ALONG NEW YORK'S LAKE ERIE COASTLINE.

New York Sea Grant Inst., Albany.
W. Fisher, N. Starler, and A. Fisher.
New York Sea Grant Institute Sea Grant Reprint Series, Reprinted from Journal of Great Lakes Research, Vol 2, No 1, p 3-11, July 1976. 2 fig, 2 tab, 13 footnotes. SG-2-35281.

Descriptors: *Water pollution control, *Environmental effects, *Property values,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

*Economics, *Lake Erie, Pollution abatement, Resources development, New York, Great Lakes.

A method is developed which enables the quantification of one type of benefit of water pollution control. It is hypothesized that water pollution tends to depress shoreline property values. A property values index is constructed which can be applied to different classifications of property types within an area. Since the index measures relative changes in property values, it can be used to compare the behavior of property values in different areas which are comparable except for the problem under study. Data for New York State's Lake Erie shoreline are used to calculate the index. The result is then compared with indexes calculated for nearby nonshore sites and for properties along Chautauqua Lake, which has experienced less water pollution. The Chautauqua Lake results provide a benchmark to show what might have been expected along Lake Erie, if it had been cleaner. It can be predicted that the relatively depressed property values along Lake Erie will show growth similar to those along Chautauqua Lake, if the population is alleviated. This quantification of some of the benefits provides strong policy implications for pollution abatement programs along Lake Erie. The index could easily be applied to other Great Lakes areas. (NOAA)

W77-12960

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STORM WATER MANAGEMENT MODEL: LEVEL I - PRELIMINARY SCREENING PROCEDURES.
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W77-12476

A MODEL TO PREDICT TOTAL ENERGY REQUIREMENTS AND ECONOMIC COSTS OF IRRIGATION SYSTEMS.
Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12503

ENVIRONMENTAL MANAGEMENT AND REGIONAL ECONOMIC DEVELOPMENT.
West Virginia Univ., Morgantown. Regional Research Inst.
For primary bibliographic entry see Field 5G.
W77-12583

RESOURCE ADEQUACY IN LIMITING NON-POINT POLLUTION.
Iowa State Univ., Ames.
For primary bibliographic entry see Field 5B.
W77-12615

OPTIMIZATION OF WATER USE FOR IRRIGATION.
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12617

A LINEAR PROGRAMMING MODEL FOR ASSESSING THE REGIONAL IMPACTS OF ENERGY DEVELOPMENT ON WATER RESOURCES.
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
G. Provenzano.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 022,

Price codes: A06 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana, Report UTLU-WRC-77-0126, Research Report No. 126, July 1977. 104 p, 24 tab, 10 fig, 4 ref. OWRT B-092-ILL(4).

Descriptors: Energy, Natural resources, Optimization, *Linear programming, Planning, Power plants, Forecasting, *Regional development, Systems analysis, Water resources, *Model studies, *Regional analysis.
Identifiers: *Energy-related water demands, Coal gasification, *Energy development.

Development and application are discussed of a multiperiod, multiplant linear programming model of an energy production system and associated water supply components. The model simultaneously appraises alternative expansion strategies and operating schedules for steam-electric power generation and coal gasification industries. The model identifies the type, size, location, and sequence of construction of new energy production facilities; and the levels of energy production and transmission that minimize the costs of meeting demands for electricity and gas over a specified future time period. For each minimum-cost expansion strategy that is identified, the model also determines corresponding information about the amount, location, and sequence with which water will be used in future energy production. This information is, in effect, a spatially disaggregated projection of the allocation and demand for energy-related uses of water. The model was implemented using the state of Illinois as a case study region. The results from this application indicate that projected gross withdrawals of water for steam-electric power generation will decline while consumptive demands for this use will increase. Spatially, future patterns of water use for power generation are likely to be more evenly distributed throughout the state. The development of a coal gasification industry in Illinois is likely to bring about a sizeable increase in future energy-related water demands.

W77-12633

MISSOURI RIVER MAIN STEM RESERVOIR REGULATION STUDIES.
Northern Great Plains Resources Program. Denver, Colo.
For primary bibliographic entry see Field 4A.
W77-12819

ATLANTIC OFFSHORE USERS WORKSHOP MAY 19-21, 1977, NEWARK, DELAWARE.
Delaware Univ., Newark. Coll. of Marine Studies. Delaware University College of Marine Studies Sea Grant Report No. DEL-SG-11-77, June 1977. 302 p. W. S. Gaither (Chairman).

Descriptors: *Continental shelves, *Offshore drilling, *Topographic features, *Oceanography, *Meetings, Atlantic Ocean.
Identifiers: Resources management, *Outer Continental Shelf, U.S. East Coast, Western Atlantic Ocean, Physical oceanography.

A workshop held on May 19-21, 1977, at the University of Delaware brought together commercial users of the Atlantic offshore areas, their governmental regulators and service organizations, and Sea Grant institutional representatives. The objective was to identify, and rank in priority order, the most important oceanographic and oceanographic engineering problems (or information gaps) which, if solved, could lead to better commercial use and to better resource management practices. Participants identified 105 problems which were then consolidated into 83 that are presented in order of priority. The next step will be a second workshop to develop promising problem approaches to solve, or at least shed light on, the high priority problems. This workshop will involve most of the participants and also researchers and other individuals best able to help

develop rational and economical approaches to solving the high priority problems. (NOAA)
W77-12914

6B. Evaluation Process

OUR SHINING WATERS. A FILM ON LAKE EUTROPHICATION.
Washington State Univ., Pullman. Engineering Extension Service.
D. C. Flaherty, and A. J. Ruddy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 734. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, February 25, 1977. 39 p. OWRT A-071-WASH(1), 14-31-001-5048.

Descriptors: *Eutrophication, *Lakes, *Aesthetics, Ecology, Environment, *Social values, *Social participation, Water pollution control attitudes.

In the fall of 1974, work was begun on the planning, scripting, and production of two 16mm films on lake eutrophication and the environmental inter-relationships of man and lakes. One film - 'Too Young to Die' - was supported by funds from the Washington State Department of Ecology. The second - 'Our Shining Waters' - was funded by the U.S. Office of Water Research and Technology. Both productions were made under the auspices of the State of Washington Water Research Center. The two films were alike in a number of respects, including the use of some duplicate footage and sound tracks. This commonality of use made it possible to tailor the films to the different sponsor's objectives while keeping the production costs at a minimum. The films were made to illustrate the following points: The economic and aesthetic values of lakes; How the life of these bodies of water can be extended through citizen action and cooperation; What corrective action and studies have been done at some lakes in Washington State by citizens, industries, governmental agencies, and university research scientists and engineers; The physical and biological factors involved in lake deterioration: 1. The flora and fauna communities of lakes and how they interact, and 2. The algae and how they can become a major problem; Selected field and laboratory studies done in Washington State by Washington State University, University of Washington, and Eastern Washington State College under the sponsorship of the Washington Department of Ecology, other state agencies, and the U.S. Office of Water Resources and Technology.
W77-12266

VERMONT'S NEEDS IN WATER RESOURCES RESEARCH.
Vermont Univ., Burlington. Water Resources Research Center.
E. A. Cassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 890. Price codes: A08 in paper copy, A01 in microfiche. Completion Report, August 1977. 163 p, 2 fig, 33 tab, 17 ref, 6 append. OWRT A-021-VT(2).

Descriptors: *Vermont, *Research priorities, Priorities, *Research and development, Evaluation, *Water quality, Water pollution sources, Water pollution effects, Municipal water, Waste water treatment.
Identifiers: *Groundwater quality protection, Non-point sources of pollution.

This study, the first complete analysis of Vermont's water resources research needs, consisted of a three-step program. First, sixty-two individuals, knowledgeable about Vermont's water resource problems, were interviewed. A questionnaire developed from these interviews was sent to some 800 individuals across the State. Finally, a highly controlled round table discussion was held

and was concerned with a single research topic of high priority. Research on ground water quality protection, lake and reservoir quality degradation, non-point source pollution and municipal waste water systems are of high priority. The research topics of alternative planning methodologies, wetland quality management, management of excess water and institutional relationships at the local, regional and state-wide levels were considered to be of low overall importance. The three-fold plan provided a comprehensive evaluation of Vermont's water resources research needs as perceived by individuals representing a number of disciplinary, organizational and regional backgrounds. This method may have application in identifying research needs in other regions of the United States.
W77-12268

ATTITUDES AND SOCIAL CHARACTERISTICS OF FARM AND RURAL NON-FARM PERSONS LIVING ADJACENT TO THE SHEYENNE RIVER OF NORTH DAKOTA, Concordia Coll., Moorehead, Minn. Dept. of Sociology.
L. L. Falk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 719, Price codes: A04 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Technical Report No. WI-312-002-77, July 1977. 53 p, 60 tab, 21 ref, append. B-030-NDAK(1), 14-31-0001-5102.

Descriptors: *Surveys, *Attitudes, Social aspects, *Rural areas, *River basin development, *North Dakota, Post-impoundment, Flood control.
Identifiers: *Sheyenne River Basin(N DAK), Red River of the North.

Two surveys were conducted in 1973 and 1976 which assessed attitudes and social characteristics of rural farm and non-farm persons living adjacent to the Sheyenne River between Bald Hill Dam and the Red River of the North. The surveys are part of a five-year study being conducted in North Dakota entitled, 'Water Quality and Land Use in the Sheyenne River Basin: An Interdisciplinary Analysis.' The surveys show a general awareness of the role Bald Hill Dam plays in flood control but show no generalized attitudes with respect to other factors (fishing, agriculture, tourism, wildlife). (See also W77-12272)
W77-12271

A POPULATION PROFILE OF THE LOWER SHEYENNE RIVER BASIN IN NORTH DAKOTA, Concordia Coll., Moorehead, Minn. Dept. of Sociology.
L. L. Falk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 731, Price codes: A05 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Technical Report No. WI-312-003-77, August 1977. 71 p, 33 tab, 21 fig, 24 ref. OWRT B-030-NDAK(2), 14-31-0001-5102.

Descriptors: Population, Profiles, Census, Social aspects, *Projections, Data collections, *North Dakota, *Human population, Correlation analysis.
Identifiers: *Sheyenne River Basin(N DAK), *Population profiles(Human).

This study, as part of a larger study, focused on populations in the Sheyenne River Basin. The study is in four parts as follows: (1) a population profile of four counties (Barnes, Cass, Ransom and Richland); (2) information on twelve Census County Divisions that are adjacent to the Sheyenne River; (3) a correlational analysis of 29 selected social and housing characteristics from these twelve Census County Divisions; and (4) the results of population projections based on available demographic data. Tables are included com-

paring these four counties and twelve CCD's. (See also W77-12271)
W77-12272

WATER QUALITY MANAGEMENT IN THE SOVIET UNION, Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5G.
W77-12398

WATER QUALITY MANAGEMENT - QUALITY PLANNING, Thames Water Authority, London (England) HQ Scientific Services.
For primary bibliographic entry see Field 5G.
W77-12401

SCIENTIFIC AND TECHNICAL EVALUATION OF THE ENVIRONMENTAL PROTECTION AGENCY'S WASTEWATER FACILITIES PLANNING, BOSTON CASE STUDY, PHASE I: WATER QUALITY CONSIDERATIONS, Resource Analysis Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W77-12472

UPPER SUWANNEE RIVER: EVALUATION OF A PROPOSED DRI AS AN AREA OF CRITICAL STATE CONCERN, Florida Dept. of Administration, Tallahassee. Div. of State Planning.
For primary bibliographic entry see Field 6G.
W77-12584

DEVELOPMENT OF A PROCEDURE FOR FORECASTING LONG RANGE ENVIRONMENTAL IMPACTS, REPORT TO THE RESOURCE AND LAND INVESTIGATIONS PROGRAM (RALI), Stanford Univ., Calif. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 6G.
W77-12589

SOCIOECONOMIC ASPECTS OF DREDGED MATERIAL DISPOSAL: THE CREATION OF RECREATIONAL LAND IN URBAN AREAS, Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 5G.
W77-12590

OPTIMIZATION OF WATER USE FOR IRRIGATION, North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12617

THE IMPACT OF ENERGY DEVELOPMENT ON WATER RESOURCES IN THE UPPER COLORADO RIVER BASIN, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3E.
W77-12630

A LINEAR PROGRAMMING MODEL FOR ASSESSING THE REGIONAL IMPACTS OF ENERGY DEVELOPMENT ON WATER RESOURCES, Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6A.
W77-12633

PLANNING A LARGE IRRIGATION PROJECT, Rainbow Mfg., Co., Fitzgerald, Ga.
For primary bibliographic entry see Field 3F.
W77-12711

TOWARDS A GENERAL GUIDELINE OF IRRIGATION WATER CHARGING POLICY, Universitaet Hohenheim (Landwirtschaftliche Hochschule) (West Germany). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W77-12826

RESERVOIR MANAGEMENT AND THE WATER SCARCITY ISSUE IN THE UPPER COLORADO RIVER BASIN, New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 4A.
W77-12839

ATLANTIC OFFSHORE USERS WORKSHOP MAY 19-21, 1977, NEWARK, DELAWARE, Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 6A.
W77-12914

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ADVANCED SEWAGE TREATMENT FAILS COST-ENVIRONMENTAL BENEFIT TEST, For primary bibliographic entry see Field 5G.
W77-12431

COST ESTIMATING MANUAL-COMBINED SEWER OVERFLOW STORAGE AND TREATMENT, Culp, Wesner, Culp-Clean Water Consultants, El Dorado Hills, Calif.
For primary bibliographic entry see Field 5D.
W77-12494

A MODEL TO PREDICT TOTAL ENERGY REQUIREMENTS AND ECONOMIC COSTS OF IRRIGATION SYSTEMS, Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12503

THE PRODUCTION OF WATER FROM GEOTHERMAL RESERVOIRS: SOME ECONOMIC CONSIDERATIONS, California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 3A.
W77-12682

A NOTE ON THE USE OF ECONOMIC INCENTIVES IN WATER POLLUTION ABATEMENT, Technical Univ. of Denmark, Lyngby. Dept. of Chemical Engineering Economics.
For primary bibliographic entry see Field 5G.
W77-12718

TOWARDS A GENERAL GUIDELINE OF IRRIGATION WATER CHARGING POLICY, Universitaet Hohenheim (Landwirtschaftliche Hochschule) (West Germany). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W77-12826

6D. Water Demand

OPTIMAL ON-FARM ALLOCATION OF IRRIGATION WATER, Escuela Nacional de Agricultura, Chapingo (Mexico). Colegio de Postgraduados.
For primary bibliographic entry see Field 3F.
W77-12719

Field 6—WATER RESOURCES PLANNING

Group 6D—Water Demand

HYDROLOGY OF THE SAHARA,

United Nations Educational, Scientific and Cultural Organization, Cairo (Egypt). Regional Office of Science and Technology for the Arab States. C. E. Gischler.

Ecological Bulletins (Stockholm), Vol. 24, p 83-101, 1976, 2 fig, 5 tab, 10 ref.

Descriptors: *Deserts, *Water shortage, *Water sources, *Water demand, *Available water, Arid lands, Africa, Hydrology, Atmospheric pressure, Climatology, Rainfall, Precipitation (Atmospheric), Monsoons, Surface waters, Groundwater, Evaporation, Recharge, Aquifers, Droughts, Water supply.

Identifiers: *Sahara, Nile River, Niger River, Chad Basin.

The water demands and availability of water in the Sahara desert of Africa are discussed. The climatology of the Sahara, the mountainous water divides of the area, the surface waters introduced from the south, evaporation losses, and recharge and groundwater in the area are described. The effects of the Nile and Niger Rivers and the Chad Basin upon the hydrology of the Sahara are presented. The large Saharan aquifers are described. The bulk of total water reserve stored under the Sahara can be found in the high potential Saharan aquifers. Detail is presented on the location, content and other characteristics of these aquifers. The twin dependencies on rainwater for food production and groundwater for drinking make the region sensitive to drought. Methods of conserving available water are evaluated. (Jamail-Arizona)

W77-12834

ENERGY AND THE COLORADO RIVER,

Utah State Univ., Logan, Dept. of Economics.

J. C. Anderson, and J. E. Keith.

Natural Resources Journal, Vol. 17, No. 2, p 157-168, April 1977. 1 fig, 6 tab, 14 ref.

Descriptors: *Colorado River, *Colorado River Basin, *Water policy, *Water allocation (Policy), River basins, Mexican Water Treaty, Mexico, Boulder Canyon Project Act, Federal-State Water Rights Conflicts, Water demand, Water shortage, Water quality, Water rights, Energy, Legal aspects, Hydroelectric power, Colorado, Utah, Competing uses.

Identifiers: Winters Doctrine.

The Colorado River Basin covers a large and diverse area of the intermountain and southwestern United States. Its drainage covers seven states and water from the basin serves the needs of 15 million people in supplying water for cities, irrigated agriculture, energy production, industry and mining. The allocation system on the Colorado River operates on four levels: international, interregional, interstate and intrastate. The Mexican Water Treaty of 1944, the Colorado River Compact of 1922 and the Boulder Canyon Project of 1928 provide the basic framework for the first three of these relationships. The legal problems of water use from the Colorado River are discussed as are the competing users of the river's water. The problems of water quality and energy development utilizing Colorado River water are examined. Energy may have significant impacts on local and regional water allocations and quality. Upon whom the impact falls will depend to a great extent on institutional and economic constraints and incentives imposed, either as a result of historical development or future policy directions. A strong objective look at the social, economic, and physical problems as they can be anticipated is recommended with less concern for the sensational elements of the planning process. (Jamail-Arizona)

W77-12836

THE NEED FOR A REFORM OF WATER USE LAW IN ILLINOIS,

Illinois State Office of the Attorney General, Springfield.

For primary bibliographic entry see Field 6E.

W77-12884

IMPACTS OF WATER AVAILABILITY ON RESIDENTIAL DEVELOPMENT,

Westfield State Coll., Mass.

A. Driscoll.

Journal of Soil and Water Conservation, Vol 3, No 4, p 156-60, July/August 1976. 1 chart, 24 ref.

Descriptors: *Local governments, *Water resources development, *Planning, *Water supply development, *Land use, Land development, Zoning, Water supply, Water zoning, Water utilization, Surveys, Data collections, Cities, Massachusetts, Northeast U.S., Water resources.

In-depth research has revealed that the availability of water from a municipal system can play an important role in controlling the development of communities in areas throughout the United States. The means of land use control advocated by water resource planners is theoretically possible even in the water-rich Northeast. This study was done in eight communities in and around Boston, with planners and other organizational people polled as to what contributed to the growth of each of their respective communities. The author points out that before water supply facilities can be used to control land use patterns, there are a number of issues that must be resolved. These include attitudes about water, the political nature of the planning and decision-making process, and the legal issues of taking and restrictive zoning. Given a greater public awareness of the necessity for stopping urban sprawl and unplanned development, water supply facilities can and should be used to influence land use planning. (Frank-Florida)

W77-12891

6E. Water Law and Institutions

WATER RESOURCES OF THE SATUS CREEK BASIN, YAKIMA INDIAN RESERVATION,

WASHINGTON,

Geological Survey, Salt Lake City, Utah. Water Resources Div.; and Geological Survey, Tacoma, Wash. Water Resources Div.

For primary bibliographic entry see Field 4A.

W77-12383

WATER QUALITY MANAGEMENT--WASTE DISPOSAL: A WATER AUTHORITY VIEW-POINT,

Thames Water Authority, London (England). Conservancy Div.

For primary bibliographic entry see Field 5E.

W77-12428

REPORT ON STATE SEDIMENT CONTROL INSTITUTES PROGRAM,

Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.

For primary bibliographic entry see Field 5G.

W77-12565

HUTCHINSON ISLAND: EVALUATION AS A POTENTIAL AREA OF CRITICAL STATE CONCERN,

Florida Dept. of Administration, Tallahassee. Div. of State Planning.

For primary bibliographic entry see Field 6G.

W77-12585

CONTINUING NEED FOR IMPROVED OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS,

General Accounting Office, Washington, D.C.

For primary bibliographic entry see Field 5D.

W77-12586

INSTITUTIONAL AND ENVIRONMENTAL ASPECTS OF GEOTHERMAL ENERGY DEVELOPMENT,

Jet Propulsion Lab., Pasadena, Calif.

For primary bibliographic entry see Field 6G.

W77-12679

ENERGY AND THE COLORADO RIVER,

Utah State Univ., Logan, Dept. of Economics.

For primary bibliographic entry see Field 6D.

W77-12836

WATER LAW IN NEW ZEALAND,

Auckland Univ. (New Zealand). School of Law.

D. A. R. Williams.

Earth Law Journal, Vol 1, No 3, p 221-37, August 1975.

Descriptors: *Comprehensive planning, *Classification, *Water permits, *Water rights, Legislation, Natural resources, Governments, Conservation, Water utilization, Pollution, Permits, Judicial decisions, Administrative agencies, Legal aspects, Water resources, Water management (Applied), Regulation, Water policy, Public rights.

Identifiers: *Comparative law, *Administrative regulations, *Standing (Legal), *New Zealand (Water and Soil Conservation Act).

Until recently legislative intervention in New Zealand into water law areas has been minimal, with most legislation dealing primarily with water use. In 1967 the legislature, recognizing a need for comprehensive regulation to deal with the complexities of modern water resources problems, enacted the Water and Soil Conservation Act. This Act, which applies to all kinds of natural water, eliminated private water rights and created an administrative structure to regulate water use. Under the Act a Regional Water Board regulates the use of all water rights by granting permits based upon a classification system. Although the Act is indicative of New Zealand's commitment to control pollution, it has several serious defects. One significant problem with the Act is that it fails to identify long-term goals and objectives. In addition there is an insufficient range of classifications and those that now exist are defined in vague terms. Finally, there is a restrictive approach to the question of standing to object to classifications and to the granting of water rights. All these problems are discussed by reference to actual cases with the hope that the committee presently reviewing the statute will consider them. (Petruff-Florida)

W77-12883

THE NEED FOR A REFORM OF WATER USE LAW IN ILLINOIS,

Illinois State Office of the Attorney General, Springfield.

G. W. Wolff.

Chicago-Kent Law Review, Vol 53, No 1, p 22-56, 1976.

Descriptors: *Illinois, *Water supply, *Water allocation (Policy), *Competing uses, Dependable supply, Potential water supply, Ground water, Governments, Federal government, Common law, Legislation, Groundwater availability, Lake Michigan, State governments, Water demand, Water distribution (Applied), Water policy, Water resources, Water resources development, Water supply development, Reasonable use, Prior appropriation.

Identifiers: Model Water Use Act (Ill).

Inadequacies in the legal and institutional structure responsible for the allocation and conservation of the water resources in Illinois may soon produce a water shortage despite the fact that Illinois is blessed with an abundance of water. Federal laws prohibit the widespread distribution of water from the seemingly endless water supply of Lake Michigan. The allocation of other ground and surface water in Illinois is governed by common law principles. The relative rights of competing water uses from the same source are uncertain and undefined. Although appellate opinions on the topic are scarce, the reasonable use standard has been found to be the law in judicially allocating surface water supplies. Because of Illinois' economic growth, common law notions of water allocation are no longer feasible. The statutory allocation programs in use in most Eastern states provide more meaningful alternatives as does the Model Water Use Act. In dealing with statutory water allocation programs the usufructuary rights of a property owner in water that passes over and beneath his land must be considered. Severe limitation on an owner's access to this water might be an unconstitutional taking of Property. (Moorhouse-Florida)
W77-12884

OCEAN DUMPING REGULATION: AN OVERVIEW

For primary bibliographic entry see Field 5G.
W77-12885

WATER PROJECTS GO UNDERGROUND

Southern California Metropolitan Water District, Los Angeles.
For primary bibliographic entry see Field 4B.
W77-12886

LAW OF GROUND WATER IN PENNSYLVANIA

Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 4B.
W77-12887

ANIMAL FEEDING FACTORIES AND THE ENVIRONMENT: A SUMMARY OF FEEDLOT POLLUTION, FEDERAL CONTROLS, AND OKLAHOMA LAW

For primary bibliographic entry see Field 5G.
W77-12888

RECLAMATION LAW IN LITIGATION: ACREAGE AND RESIDENCY LIMITATIONS ON PRIVATE LANDS

A. K. Kelley.
South Dakota Law Review, Vol 21, p 695-735, Summer 1976.

Descriptors: Agriculture, *Land reclamation, *Federal Reclamation Law, *Acreage, Judicial decisions, Legal aspects, Law enforcement, Federal government, Reclamation, Projects, Federal project policy, Land use, Land management, Regulation, Administration, Irrigation, Land tenure, Water rights, Irrigation districts.
Identifiers: *Residency requirements, *Boulder Canyon Project, Property interests, Department of the Interior.

Throughout the 75 year history of federal reclamation law, provisions for acreage and residency limitations have often failed to eliminate the monopolistic and speculative evils at which they were directed, and have not been uniformly enforced. In the last five years there have been proposals both to eliminate the limitations and to enforce them more strictly. The author analyzes three recent United States 9th Circuit Court of Appeals cases involving the Boulder Canyon Project Act to illustrate issues that can be expected in litigation dealing with residential and acreage

requirements. The result in these cases may profoundly affect practices in other federal reclamation projects. If the acreage limitations are upheld, pressures on the Department of the Interior will increase. It will be progressively more difficult to ignore the repeated violations of the excess land laws that occur in many projects. The most critical decision, however, concerns the residency requirement. If it is held enforceable, it will apply to every district contracting with the United States for participation in federal projects. Because of the long history of non-enforcement, upheaval may very well result unless Congress re-evaluates the entire reclamation policy. (Rieck-Florida)
W77-12889

IMPACTS OF WATER AVAILABILITY ON RESIDENTIAL DEVELOPMENT

Westfield State Coll., Mass.
For primary bibliographic entry see Field 6D.
W77-12891

DREDGED MATERIAL RESEARCH PROBLEMS AND PROGRESS

Texas Univ. at Dallas, Richardson.
G. F. Lee.
Environmental Science and Technology, Vol 10, No 4, p 334-38, April 1976. 1 illus, 2 photo.

Descriptors: *Dredging, *Federal government, *Federal project policy, *Environmental effects, *Regulation, Legal aspects, Legislation, Management, Permits, Water policy, Channel improvement, Hydraulic mining, Excavation, Flood protection, Flow.
Identifiers: *Fill permits.

New dredged material disposal regulations have been promulgated as of September 1975. They require a case-by-case approach in evaluating the potential environmental impact of dredged material disposal on receiving water quality. The approach seems to be sound, but it places a large burden on the District Engineer who must evaluate a number of specific points delineated in the regulations. He should be helped by the completion of the 5-year Dredged Material Research Program, which is now evaluating the environmental impact of chemical contaminants associated with dredged sediments. The author urges more funding for this program and others like it to ensure that the regulations promulgated are the most exact and exacting possible. Research should be broken down into at least three areas: coastal zones, open waters, and deep ocean waters. Both short-term and long-term effects must be examined as well. (Frank-Florida)
W77-12892

OWNERSHIP PROBLEMS WITH RESPECT TO NON-MEANDERED OFFSHORE ISLAND

Florida Univ., Gainesville. Environmental Law Seminar.
D. Denton.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, \$1.20. 1976. 24 p.

Descriptors: *Land tenure, *Florida, *Legislation, *Islands, *Federal jurisdiction, Federal government, State governments, State jurisdiction, Judicial review, Legal review, Navigable rivers, Navigable waters, Legal aspects.
Identifiers: *Public trust doctrine.

The problem of ownership of non-meandered offshore islands are complex, especially where supposedly valid claims of the state and federal government conflict. The history of sovereign title to such land is traced from the Spanish presence in Florida to the present. Title to the beaches of such an island would probably remain with the state under the public trust doctrine. As to the island itself, a history of title to uplands in Florida is

presented along with a discussion of pertinent federal and state law. The requirements for proving valid title include: adverse possession, color of title, valuable improvements, cultivation, and a good faith belief that the land was validly owned. These requirements are fairly restrictive, especially the good faith belief, but they can be met to prove valid title. Ultimately, one could well have equities in one's favor, and yet still have few legal rights to ownership, especially as against the federal government. (Frank-Florida)
W77-12894

SECOND REPORT OF THE SPECIAL MASTER IN THE CASE OF UTAH V UNITED STATES (CONCERNING BOUNDARIES OF INLAND BODIES OF WATER AND THE NATURE OF MEANDER LINES)

Utah Law Review, Vol 1976, No 2, p 245-326, 1976.

Descriptors: *Utah, *Great Salt Lake, *Boundary disputes, *Meanders, Public lands, Legal aspects, Judicial decisions, Boundaries(Property), Ownership of beds, Lakes, State governments, Federal government, Legal review, Water law, Bodies of water, Navigable waters, Legislation, Great Basin, Geographical regions, Inland waterways.
Identifiers: Property interests, Submerged lands.

In June 1966, Congress enacted legislation authorizing a determination of ownership rights in public lands surrounding the Great Salt Lake. The state of Utah commenced an action within the original jurisdiction of the United States Supreme Court to determine the proper boundary separating state and federal land holdings. A special master was appointed and determined that the Great Salt Lake Meander Line was the proper boundary. The Supreme Court adopted the special master's report without discussion. The report itself contains a historical analysis of land holdings around the Great Salt Lake as well as considerations of both the United States' and the state of Utah's arguments. Additionally a complete and in depth history of the June 1966 congressional act is included along with a general discussion of standards used for determining the boundaries of navigable inland bodies of water and the nature of meander lines. (Moorhouse-Florida)
W77-12895

WASTE OIL STUDY (PRELIMINARY REPORT TO THE CONGRESS)

Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-12897

OPPORTUNITIES FOR IMPROVEMENT IN THE DEVELOPMENT AND EVALUATION OF DESIGN ALTERNATIVES FOR FEDERAL WATER RESOURCES PROJECTS (REPORT TO THE CONGRESS)

Comptroller General of the United States, Washington, D.C.
For primary bibliographic entry see Field 8D.
W77-12898

THE ENVIRONMENTAL EFFECTS OF DUMPING IN THE OCEANS AND GREAT LAKES

For primary bibliographic entry see Field 5G.
W77-12899

WATER QUALITY RESEARCH

For primary bibliographic entry see Field 5G.
W77-12900

200-MILE FISHERIES ZONE AND JOINT VENTURES (OVERSIGHT ON THE ADMINISTRATION OF PUBLIC LAW 94-265, THE FISHERY

Field 6—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

CONSERVATION AND MANAGEMENT ACT OF 1976. Hearings—Subcomm on Fisheries and Wildlife Conservation—Comm on Merchant Marine and Fisheries, US House of Representatives, June 25, September 28, October 1, 1976, Serial No 94-44, 205 p.

Descriptors: *Commercial fishing, *Canada, *Treaties, *International waters, Legislation, Management, International law, Fish, Fish conservation, Fish populations, Fisheries, Fishing, Mexico, Shrimp, Anadromous fish, Negotiations, Continental shelf, Alaska, Foreign countries, Foreign trade, Foreign waters.

Identifiers: *Conservation zones, *Congressional hearings, Vessels, Tuna.

Committee hearings were held on the Fishery Conservation and Management Act of 1976 and how to deal with problems in its implementation. The Act provides for new programs of national and international fishery management and a 200-mile fisheries zone. Negotiations for international cooperation have commenced with Poland, Spain, Romania, Japan, Taiwan, Mexico, Korea and others. Topics covered at the hearings include the Canadian regulatory proposals, the application procedures for permits for foreign vessels to fish within the Fishery Conservation Zone of the United States, and funding for the various programs under the new Act. The hearings concluded with testimony regarding foreign investments and joint ventures in the U. S. fishing industry. The United Kingdom, Japan, and Canada are the major nations owning 10% or more stock in U. S. fishery enterprises. The discussions centered on whether joint ventures and foreign investments can be used to subvert the 200-mile fishing zone. (Denker-Florida) W77-12901

ACREAGE LIMITATION PROVISIONS OF RECLAMATION LAW.

Hearings—Subcomm on Water and Power Resources, Comm on Interior and Insular Affairs, US House of Representatives, September 13-14, 1976, Serial No 94-79, 235 p.

Descriptors: *Federal Reclamation Law, *Water management (Applied), *Irrigation, *Irrigation districts, *Acreage, Reclamation states, Federal government, Administrative agencies, Legal aspects, Irrigation water, Irrigation programs, Irrigation systems, Land development, Agriculture, Water distribution (Applied), Irrigated land, Water resources, Water policy, Farms.

Identifiers: *Groundwater management, Excess land, Non-excess land, Congressional hearings.

The Federal Reclamation Law places a limitation on the acreage of land for which an individual landowner can obtain a water supply for a Federal reclamation project. The limitation, in effect since the original Reclamation Act of 1902, was designed for wide distribution of the benefits of public-financed reclamation projects: to promote the single family-size farm; and to preclude speculative gains from Federal investment. As of September 1976, the acreage limitation provisions applied only to excess lands; some opportunity existed for speculation in the purchase and resale of non-excess lands. The purpose of the oversight hearings was to consider whether a general modification of policy or law is necessary. One public view is that the farm economic picture has changed to the point of requiring larger investments in land and equipment and requiring larger acreages for efficient farming. The other view is that action should be taken to provide more opportunities for individual family-operated farms. The Bureau of Reclamation believes its current administration of the excess land program is between these two views. The hearing report includes summaries of excess lands by project and by district. (Sloan-Florida) W77-12902

IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT (REVIEW OF THE SOUTHWEST SEWER DISTRICT, SUFFOLK COUNTY, LONG ISLAND, NEW YORK).

For primary bibliographic entry see Field 5G. W77-12903

RECENT TANKER ACCIDENTS (HEARINGS, PART 1).

For primary bibliographic entry see Field 5G. W77-12904

AMERICAN PAPER INSTITUTE V TRAIN (CHALLENGE TO EFFLUENT LIMITATION GUIDELINES FOR PULP, PAPER AND PAPERBOARD INDUSTRY).

543 F2d 328-56 (D C Cir 1976).

Descriptors: *Waste water treatment, *Pulp and paper industry, *Water quality control, *Standards, Permits, Biochemical oxygen demand, Alkalinity, Navigable waters, Filtration, Pulp wastes, Reverse osmosis, Pollutants, Water pollution sources, Water pollution, Separation techniques, Treatment, Industrial wastes, Water pollution control, Waste water (Pollution), Judicial decisions.

Identifiers: *Effluent limitations, *Pretreatment standards (Effluents), *Effluent guidelines, Administrative regulations, Federal Water Pollution Control Act Amendments of 1972, Administrative Procedures Act.

Various paper industries as plaintiffs challenged the Environmental Protection Agency's regulations establishing effluent limitations and new source performance standards for five subcategories of the unbleached phase of the pulp, paper and paperboard industry. These guidelines were promulgated pursuant to the Federal Water Pollution Control Act Amendments of 1972. The plaintiffs contended that under the Administrative Procedures Act the District Court had jurisdiction over the review of these regulations. Defendant Environmental Protection Agency insisted that the guidelines were inextricably intertwined with Section 301 effluent limitations under the Act which are within the exclusive jurisdiction of the courts of appeal. The United States Court of Appeal held for the defendant on this issue as well as plaintiff's numerous other contentions. Among plaintiff's objections, all of which the court ultimately rejected, were: (1) improper implementation of the guidelines; (2) single number effluent limitations rather than a range of numeric values; (3) inadequate cost assessment in setting the standards; and (4) objections against the 1977 and 1983 effluent limitation guidelines which the plaintiffs argued contravenes the Act in various ways. The court held that the Agency has exercised reasoned discretion in establishing the regulations and rendered judgment for the defendant. (Quarles-Florida) W77-12905

CITY OF NEW HAVEN V TRAIN (CITY CHALLENGE TO AGENCY ACTION REGARDING SITING OF SECONDARY SEWAGE TREATMENT FACILITY).

424 F Supp 648-57 (D Conn 1976).

Descriptors: *Future planning (Projected), *Federal Water Pollution Control Act, *Water pollution control, *Cost-benefit analysis, Water law, Navigable rivers, Discharge (Water), Pre-treatment (Water), Water, Planning, Pollution abatement, Effluents, Wastes, Sewage effluents, Sludge, Sewage treatment, City planning, Alternative planning.

Identifiers: *Fill permits, *Pretreatment standards (Effluent), *Administrative regulations, *Estoppel, Environmental policy, Instream uses.

The City of New Haven challenged the Environmental Protection Agency's rejection of a proposed site for a secondary sewage treatment plant in favor of another site. The city's proposed site because it required filling several acres of tidal flats, with possible adverse ecological effects, and was more costly. The city claimed that the Agency had violated statutory limits, that it had violated its Agency guidelines in reaching a cost-benefit judgement, and that it was estopped from opposing the city's proposed site. The court found that the Federal Water Pollution Control Act of 1972 did not prohibit the Agency from considering site costs in determining grant eligibility. The Agency, however, ignored the city's arguments concerning nonmonetary costs, and applied an unwritten rule that 'nonmonetary costs are never to be permitted to override a monetary cost saving whenever the differential between the monetary costs of two competing sites exceeds \$500,000'. Because this violated published Agency rules, the court set aside the Agency's decision, even though the court rejected the city's estoppel arguments. W77-12906

COASTAL WATERWAY ACT OF 1975.

Texas Rev Civ Stat art 5415e-2, secs 1 thru 7 (Supp 1976).

Descriptors: *Texas, *Marshes, *Coastal plains, *Inland waterways, Coasts, Wildlife, Wildlife conservation, Marsh management, Wildlife habitats, Natural resources, Conservation, Water resources, Water resources development, Environmental effects, Regulation, Environmental control, Channels, Dredging, Channel improvement, Navigation.

Identifiers: *Gulf Intracoastal Waterway.

Texas' coastal lands and marshes are vital elements of the state's economy. The maintenance, preservation and enhancement of the environment and wildlife create benefits to the entire state. The Gulf Intracoastal Waterway can be operated and improved in such a way as to prevent waste of natural resources and avoid or minimize adverse environmental impacts. Because of these considerations, it is in the best interest of the state to meet the responsibilities required by federal law of the non-federal sponsor of the Gulf Intracoastal Waterway. The act will be administered by the State Highway Commission. This commission, in cooperation with all appropriate persons, shall continually evaluate the Waterway as it relates to Texas. The commission will hold public hearings prior to the acquisition of any property for any alteration of the main channel of the Waterway. The act authorizes the state legislature to appropriate funds from the general revenue fund in order to protect the natural resources of the state in the manner provided for by the act. (Rieck-Florida) W77-12907

PROHIBITION AGAINST POLLUTION.

Tex Water Code Ann sec 21.251 thru .265 (1972).

Descriptors: *Texas, *Law enforcement, *Penalties (Legal), *Water quality control, Legal aspects, Assessments, Regulation, Water law, State governments, Local governments, Jurisdiction, Permits, Administration, Economic feasibility, Water pollution, Monitoring, Water pollution sources, Oil industry, Legislation, Water quality.

The discharge of sewage, or municipal, agricultural, or industrial wastes into any waters of the state is prohibited unless authorized by rule, regulation or permit. Any violator may be subject to a civil penalty between \$50 and \$1,000 for each act and each day of violation. Civil suits may be instituted by the state's water quality board for injunctive relief to restrain violations. Local governments and the Parks and Wildlife Department may also institute suits against violators when the violations occur within their jurisdictions. The Water Quality Board has the responsibility of establish-

Ecologic Impact Of Water Development—Group 6G

ing water quality sampling and monitoring programs for the state. The Water Development Board is to investigate groundwater quality. The Parks and Wildlife Department has enforcement powers over violations affecting aquatic life and wildlife. The State Department of Health shall make recommendations to the Water Quality Board concerning the health aspects of water quality. The Railroad Commission is responsible for abatement and prevention of water pollution from oil and gas exploration, development and production activities. Pollution caused by an act of God is not a violation of this chapter. (Rieck-Florida).
W77-12908

TEXAS WATER QUALITY ACT (ESTABLISHMENT OF WATER QUALITY BOARD).
Tex Water Code Ann secs 21.001 thru .006, 21.061 thru .095, 21.351 thru .357 (1972).

Descriptors: *Texas, *Water permits, *Water quality control, *Standards, Water pollution control, Water pollution treatment, Water management (Applied), Administration, Governments, Water law, Water policy, Water control, Waste water disposal, Sewage disposal, Regulation, Inspection, Public utilities, Municipal wastes, Waste water treatment, Sewage treatment.

In the interest of maintaining water quality, the Texas Water Quality Board is given broad powers over matters relating to water use in the state. The board has power to conduct any investigations it deems necessary and to enter public and private property to make inspections or to examine records relative to the maintenance of water quality. It may issue temporary orders relating to the discharge of waste prior to notice or hearing, but must fix a hearing time and place as soon afterward as possible. The board may set standards and issue permits for pollution control. The board may enter orders controlling private sewerage facilities and may delegate to local governments the licensing and administration of such facilities. The board may develop comprehensive management plans for different areas of the state and use such plans in reviewing applications for financial assistance for construction of treatment works. Local governments have much the same authority as the board to make inspections and investigations and to bring enforcement actions. Local governments which operate their own disposal systems are subject to the requirements of this Act but may apply to the board for exceptions. (Sloan-Florida)
W77-12909

CONCEPTUAL DESIGN OF A COMPUTER SYSTEM TO SUPPORT THE OPERATIONS OF THE SUBMERGED LANDS SECTION UNDER ACT 247 AND ACT 346.
American Management Systems, Inc., Arlington, Va.; and Michigan Dept. of Natural Resources, Lansing. Bureau of Water Management.
For primary bibliographic entry see Field 7C.
W77-12961

6F. Nonstructural Alternatives

KNIFE RIVER FLOOD HAZARD ANALYSES, MERCER COUNTY, NORTH DAKOTA.
Soil Conservation Service, Bismarck, N. Dak.
For primary bibliographic entry see Field 2E.
W77-12592

FLOOD PLAIN INFORMATION: RIO SAN JOSE, PUEBLO OF LAGUNA, NEW MEXICO.
Army Engineer District, Albuquerque, N. Mex.
For primary bibliographic entry see Field 4A.
W77-12593

FLOOD PLAIN INFORMATION: ONEIDA CREEK, NEW YORK.
Army Engineer District, Buffalo, N.Y.
For primary bibliographic entry see Field 4A.
W77-12594

FLOOD PLAIN INFORMATION: COLORADO RIVER AND COUNTRY CLUB CREEK, AUSTIN, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-12595

FLOOD PLAIN INFORMATION: KIRKWOOD BRANCH AND DOVE CREEK, SOUTHLAKE, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-12596

FLOOD PLAIN INFORMATION: CANEY CREEK, MONTGOMERY COUNTY, TEXAS.
Army Engineer District, Galveston, Tex.
For primary bibliographic entry see Field 4A.
W77-12597

FLOOD PLAIN INFORMATION: COLLINS RIVER, BARREN FORK, HICKORY AND CHARLES CREEKS, MCMINNVILLE, TENNESSEE.
Army Engineer District, Nashville, Tenn.
For primary bibliographic entry see Field 4A.
W77-12598

FLOOD PLAIN INFORMATION: BROOKINGS, BROOKINGS COUNTY, SOUTH DAKOTA, VOLUME II, SIX MILE CREEK.
Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W77-12599

FLOOD PLAIN INFORMATION: SOUTHWEST STREAM GROUP, STOCKTON, CALIFORNIA.
Army Engineer District, Sacramento, Calif.
For primary bibliographic entry see Field 4A.
W77-12600

FLOOD PLAIN INFORMATION: WILLOW RIVER AND PAPERJACK CREEK, NEW RICHMOND, WISCONSIN.
Army Engineer District, St. Paul, Minn.
For primary bibliographic entry see Field 4A.
W77-12601

FLOOD PLAIN INFORMATION: WISCONSIN RIVER, COLUMBIA AND SAUK COUNTIES, WISCONSIN.
Army Engineer District, St. Paul, Minn.
For primary bibliographic entry see Field 4A.
W77-12602

FLOOD PLAIN INFORMATION: DORCHESTER, WHITMAN, QUESET, BLACK, BEAVER, POQUANTICUT, MULBERRY AND GOWARDS BROOKS, EASTON, MASSACHUSETTS.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12603

FLOOD PLAIN INFORMATION: LITTLE ANDROSCOGGIN RIVER: AUBURN, POLAND, MECHANIC FALLS, AND MINOT, MAINE.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12604

FLOOD PLAIN INFORMATION: MILLERS RIVER AND NORTH BRANCH: WINCHENDON, MASSACHUSETTS.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12605

FLOOD PLAIN INFORMATION: WEST RIVER AND UTLEY BROOK: WESTON-LONDONDERY, VERMONT.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12606

FLOOD RISK MAP, CARMAN, MANITOBA.
Department of Mines, Resources and Environmental Management, Winnipeg (Manitoba). Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12770

6G. Ecologic Impact Of Water Development

LAND AND RECREATIONAL DEVELOPMENT AT NEW JERSEY RESERVOIRS.
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Science.
S. J. Souza, and P. A. Perry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 636.
Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Water Resources Research Institute, Rutgers University, July, 1977, 22 p, 1 fig, 1 tab, 2 ref. OWRD A-043-NJ(4).

Descriptors: *Land use, *Land development, *Urbanization, Water quality, *Phosphorus, *Nutrients, Planning, Institutions, Water resources development, Chlorophyll, *Eutrophication, Trophic level, *New Jersey, Recreation, Reservoirs.

The land-use study illustrates the rapid residential and urban growth which has occurred around major impoundments in the suburban portions of New Jersey, especially Lake Hopatcong, and projects further development in the future. Current housing trends indicate increasing percentages of small lot single family homes and of multiple family housing. The practicable limits on capacity of such areas for human occupation may lie not with water supply or sewage treatment facilities but with the pollution resulting from dispersed sources and runoff, and with the resulting environmental degradation, especially of lakes and impoundments. The proposed Six Mile Run Reservoir was chosen for further study because it exemplifies a planned reservoir in a rapidly urbanizing area, the future of which will be greatly affected by decisions to be made soon. Phosphorus loadings for Six Mile Run Reservoir were computed from storm and low flow data, and found to check closely with computed loads under present conditions. With this verification, estimates were made of projected future loadings under two alternative zoning plans. Further estimates confirm that initially satisfactory trophic conditions may be expected to deteriorate markedly unless remedial land-use controls are adopted, including controls during the construction period. (Whipple-Rutgers)
W77-12257

AQUATIC NATURAL AREAS IN IDAHO.
Idaho Univ., Moscow. Dept. of Biological Sciences.
For primary bibliographic entry see Field 4A.
W77-12269

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

A COMMUNITY DEVELOPER'S ROLE IN ENVIRONMENTAL PLANNING AND MONITORING.
Soil Conservation Service, Lincoln, Nebr. Midwest Technical Service Center.
For primary bibliographic entry see Field 5C.
W77-12396

ENVIRONMENTAL MANAGEMENT AND REGIONAL ECONOMIC DEVELOPMENT.
West Virginia Univ., Morgantown. Regional Research Inst.
For primary bibliographic entry see Field 5G.
W77-12583

UPPER SUWANNEE RIVER: EVALUATION OF A PROPOSED DRI AS AN AREA OF CRITICAL STATE CONCERN.
Florida Dept. of Administration, Tallahassee. Div. of State Planning.
Report DSP-BLP-C-3-7-74, March 1974. 31 p, 2 fig, 1 tab, 16 ref, 2 append.

Descriptors: *Land use, *Flooding, *Mining, *Environmental effects, *Florida, History, Phosphates, Water quality, Recreation, Estuarine fisheries, Archaeology, Sinks, Springs, Design flood.
Identifiers: *Phosphate mining, *Development of Regional Impact(DRI), *Suwannee River(FL), Historic sites, Columbia County(FL), Hamilton County(FL).

A Development of Regional Impact (DRI) in Hamilton and Columbia counties, Florida, is assessed as a potential area of critical state concern. The development consists of the major expansion of an existing phosphate mining operation that would affect a thirty mile reach of the Suwannee River. Several resources of regional or statewide importance were threatened by the mining and processing operation, including the great natural beauty of the Suwannee; the quality of the water of the Suwannee River and its tributaries, high quality water being essential to recreational and other users and to the protection of the estuarine fisheries affected by the river; several historical and archaeological sites; the springs and sinkholes of the area that affect the upper aquifer, the river, and its tributaries; and rare and endangered animals and plant communities. Most of these resources are within the 100-year flood plain or are related to it. The most serious danger to these resources is posed by mining or related operations which lie within the flood plain. Negotiations with mining company officials resulted in modification of the proposed development. State officials were satisfied with these modifications and consequently recommended that the area not be designated as an area of critical state concern. (Nessa-NC)
W77-12584

HUTCHINSON ISLAND: EVALUATION AS A POTENTIAL AREA OF CRITICAL STATE CONCERN.
Florida Dept. of Administration, Tallahassee. Div. of State Planning.
Report DSP-BLP-C-4-10-74, March 1974. 14 p, 2 fig, 7 ref.

Descriptors: *Barrier Islands, *Environmental effects, *Land use, *Planning, *Florida, Density, Population, Community development, Ecology, Balance of nature, Flooding, Coasts, Hurricanes, Investment, Monitoring, Market value.
Identifiers: Hutchinson Island(FL), Residential development, Public investment, Martin County(FL), St. Lucie County(FL).

Because of state and local concern, the Florida Bureau of Land Planning undertook a study of Hutchinson Island to evaluate its potential as an area of critical state concern. The Island is a 23 mile long barrier island located in Martin and St.

Lucie Counties, Florida. It is bounded by Pierce Inlet on the north, St. Lucie Inlet on the south, the Atlantic Ocean, and the Indian River Intracoastal Waterway. The concerns about the Island's future include: the protection of environmental resources and functions from unsound development; the need to allow reasonable development and residential density because of population pressures and market values; protection of future public investments from the effects of rapid or uncoordinated development that is excessively intensive; and protection from the threat of hurricane flooding since nearly all of the developable land is in a hurricane flood zone. On the basis of this study's findings, it is recommended that the Island not be recommended as an area of critical state concern, but this recommendation should be reevaluated if local regulatory and planning efforts prove ineffective; the state should acquire environmentally endangered lands, especially in those areas where the land's physical structure will make local regulation difficult or impossible; and state agencies should strongly support the planning and implementation efforts of local jurisdictions, especially with respect to the creation of a council of governments. (Nessa-NC)
W77-12585

NORTHERN GREAT PLAINS RESOURCES PROGRAM: WATER QUALITY SUBGROUP REPORT.
Northern Great Plains Resources Program, Denver, Colo.
For primary bibliographic entry see Field 5C.
W77-12588

DEVELOPMENT OF A PROCEDURE FOR FORECASTING LONG RANGE ENVIRONMENTAL IMPACTS, REPORT TO THE RESOURCE AND LAND INVESTIGATIONS PROGRAM (RALI).
Stanford Univ., Calif. Dept. of Industrial Engineering.
B. Schlesinger, and D. Daetz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 974. Price codes: A08 in paper copy, A01 in microfiche. Prepared for U.S. Geological Survey, August 1975. 137 p, 31 tab, 17 fig, 78 ref.

Descriptors: *Environmental effects, *Ecology, *Linear programming, *Forecasting, *Strip mines, Input-output analysis, Analytical techniques, Model studies, Great Plains, Indexing, Institutional constraints, Methodology.
Identifiers: *Environmental impacts, Impact matrix, Cross-impact matrix.

Environmental impact studies generally emphasize a project's direct air, water, and surface effects, known as primary effects. This study presents a systematic procedure for forecasting higher order long range effects of large scale projects. The study's methodology combines a schedule of primary environmental impacts anticipated from future activities with a matrix of environmental factor relationships. Each term in this cross-impact matrix relates a change in one factor in one year to a change in another factor the following year by a linear multiplier. An extended version of the matrix is proposed that contains additional terms to reflect the impact of several environmental factors changing at the same time. A case study involving strip mining of coal in the Northern Great Plains region is used to test the procedure's concept and formulation. This procedure's contribution to impact assessment methodology includes: the merging of a project schedule with higher order effects to provide more complete forecasts in each time interval; the extension of the cross-impact matrix configuration to allow consideration of impacts caused by simultaneous effects in the environment; and the implementation of a contingency analysis that considers the client agencies' limitations in control over key variables. (Nessa-NC)
W77-12589

SOCIOECONOMIC ASPECTS OF DREDGED MATERIAL DISPOSAL: THE CREATION OF RECREATIONAL LAND IN URBAN AREAS.
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 5G.
W77-12590

INSTITUTIONAL AND ENVIRONMENTAL ASPECTS OF GEOTHERMAL ENERGY DEVELOPMENT.
Jet Propulsion Lab., Pasadena, Calif.
O. R. Citron.
Nuclear Technology, Vol 34, No 1, p 38-42, June, 1977. 3 ref.

Descriptors: *Thermal power, *Environmental effects, *Social aspects, Land use, Air pollution, Water pollution sources, Land subsidence, Thermal waters, Economic impact, Energy.
Identifiers: Environmental impact statements, Noise.

Increasing interest in exploiting a variety of geothermal resources has prompted an examination of institutional and environmental barriers to their commercial use. Because geothermal resources are single, unique supply sources utilized on the site of discovery, space requirements and land use conflicts could easily arise, as well as great concern over the impact of large-scale development on the lifestyle of a surrounding rural community. Problems of noise, air quality (especially the emission of H₂S), land subsidence, and water pollution loom as potential ecological consequences of geothermal power station construction. Environmental Impact Statement processes, while protecting public interest to some degree, also stand as considerable complications to decision-making activities regarding geothermal development. Federal efforts are urged toward striking a balance between institutional, and community needs in order to assure ease of development of much-needed thermal power without major sacrifices of environmental quality and community self-determination. (Eberle-NWWA)
W77-12679

HYDROLOGY OF THE SAHARA.
United Nations Educational, Scientific and Cultural Organization, Cairo (Egypt). Regional Office of Science and Technology for the Arab States.
For primary bibliographic entry see Field 6D.
W77-12834

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN UTAH.
Army Engineer District, San Francisco, Calif. South Pacific Div.
January 1977. 44 p.

Descriptors: *Water resources development, *Utah, *Flood control, Water resources, Drainage, Flood plain management, Water quality control, Colorado River, Great Basin, Great Salt Lake, Water resources planning.

This booklet provides information on the scope and progress of current United States Army Corps of Engineers programs in the state of Utah. Data are presented on several aspects of water resources development in Utah and the role of the Corps of Engineers in planning, constructing and operating water projects. The material on the projects is grouped according to basins. These include the Great Salt Lake Basin, Sevier Lake Basin, Green River Basin, and the Colorado River Basin, and represent the major drainage patterns in the state. The history of the Corps of Engineers' activities in Utah is traced and its involvement in flood control, water quality control and flood plain management is presented. The integration of local interests into federal water projects is discussed. (Jamail-Arizona)
W77-12838

FINAL ENVIRONMENTAL IMPACT STATEMENT PROPOSED ESTUARINE SANCTUARY GRANT AWARD FOR ROOKERY BAY, COLLIER COUNTY, FLORIDA TO STATE OF FLORIDA.

National Oceanic and Atmospheric Administration, Washington, D.C. Office of Coastal Zone Management.

For primary bibliographic entry see Field 2L.
W77-12957

STATE OF CALIFORNIA COASTAL MANAGEMENT PROGRAM AND FINAL ENVIRONMENTAL IMPACT STATEMENT.

National Oceanic and Atmospheric Administration, Washington, D.C. Office of Coastal Zone Management; and California Coastal Zone Conservation Commissions, San Francisco.

For primary bibliographic entry see Field 2L.
W77-12959

ENVIRONMENTAL IMPACT ON PROPERTY VALUES ALONG NEW YORK'S LAKE ERIE COASTLINE.

New York Sea Grant Inst., Albany.
For primary bibliographic entry see Field 5G.
W77-12960

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL TECHNICAL SUMMARY REPORT.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

Annual Reports Summary for the Year Ending March 1976, (1976). 587 p.

Descriptors: *Continental Shelf, *Water pollution, *Baseline studies, *Resources development, *Environmental effects, *Alaska.
Identifiers: *Outer Continental Shelf.

The function of the Outer Continental Shelf Environmental Assessment Program (OCSEAP) is to coordinate all Alaskan marine environmental assessment activities relating to energy development. The multi-faceted program which developed to provide the required input covers a broad spectrum of disciplines and employs hundreds of scientists and assistants. Following the annual executive summary, separate sections deal with the following areas: Lower Cook Inlet, Kodiak Island, Northeast Gulf of Alaska, Bristol Bay-St. George Basin, and the Beaufort Sea. Each section presents information on the local environment, pollution sources, various hazards, transport processes, receptors and environmental effects of the various activities on the Alaskan Continental Shelf. (NOAA)

W77-12963

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 1: RECEPTORS (BIOTA): MARINE MAMMALS; MARINE BIRDS; MICROBIOLOGY.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

Feb 1977. 838 p.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Ecological distribution, *Environmental effects, *Water resources, Mammals, Birds, Ecology, Microbiology, Habitats.
Identifiers: Outer Continental Shelf, Environmental assessment, Environmental impact.

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaskan Continental Shelf. The multi-year program is

directed by the National Oceanic and Atmospheric Administration under the sponsorship of the Bureau of Land Management. The baseline studies in this volume deal with marine mammals, marine birds, and microbiology. (NOAA)
W77-12964

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 2: RECEPTORS (BIOTA): FISH; PLANKTON; BENTHOS; LITTORAL.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

Feb 1977. 991 p.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Environmental effects, *Data collections, Aquatic life, Marine fish, Plankton, Aquatic algae, Benthos.
Identifiers: Outer Continental Shelf, Environmental assessment, Environmental impact.

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaskan Continental Shelf. The multi-year program is directed by the National Oceanic and Atmospheric Administration under the sponsorship of the Bureau of Land Management. The baseline studies in this volume deal with fish, plankton, benthos and littoral biota. (NOAA)
W77-12965

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 4: HAZARDS; DATA MANAGEMENT.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

February 1977. 543 p.

Descriptors: *Alaska, *Earthquakes, *Hazards, *Baseline studies, *Resources development, *Environmental effects, Seismology, Ice cover, Permafrost, Data.
Identifiers: Outer Continental Shelf, Environmental assessment, *Environmental impact, Tectonics, Data management.

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaskan Continental Shelf. The multi-year program is directed by the National Oceanic and Atmospheric Administration under the sponsorship of the Bureau of Land Management. The baseline studies in this volume reports studies on the hazards man made and natural in the environs of Alaska and the second part of this volume deals with data management and program coordination. The investigators have filed environmental data submission schedules. (NOAA)
W77-12966

7. RESOURCES DATA

7B. Data Acquisition

RESEARCH ON EFFICIENT WATER USE,
Indian Agricultural Research Inst., New Delhi.
Nuclear Research Lab.

For primary bibliographic entry see Field 2G.
W77-12282

TWO NEW METHODS FOR OBTAINING WATER SAMPLES FROM SHALLOW AQUIFERS AND LITTORAL SEDIMENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.; and Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.

P. H. John, M. A. Lock, and M. M. Gibbs.
Journal of Environmental Quality, Vol 6, No 3, p 322-324, July-September 1977. 5 fig, 6 ref.

Descriptors: *Water sampling, *Aquifers, *Sediments, *Littoral, Groundwater, Methodology, Instrumentation, Monitoring, Geochemistry, Wellpoints, Plastic pipes, Water table, Nutrients, Foreign research.
Identifiers: *New Zealand, Driving head, Plunger, Cylinder.

Two sampling techniques were developed which enable groundwater samples to be obtained from various depths within shallow aquifers and littoral sediments. Both techniques involve the insertion of a percussion-driven spike to the desired depth. One method employs a sampling probe consisting of a perforated tip and a mechanism for the prevention of blockage by grit during the driving process, with samples being withdrawn through an internal plastic tube. The other technique involves permanent installation of a perforated plastic capsule connected to the surface by plastic tubing. Some examples of chemical data obtained during extensive testing of these techniques were presented. It was concluded that the techniques could have considerable application in the investigation of shallow groundwater and littoral sediment chemistry. (Visocky-ISWS)
W77-12310

USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center; and Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.

For primary bibliographic entry see Field 3B.
W77-12329

A NEW MODEL OF THICKET DREDGE, (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Institut Ozerovedeniya.
T. D. Slepukhina.
Gidrobiol Zh 12(3), p 107-108, 1976.

Descriptors: *Design, *Sampling, *Invertebrates, Aquatic plants, Leaves.
Identifiers: Pondweed, *Thicket dredge, Willowgrass.

The design and use of a thicket dredge, intended for collecting samples of phytoplankton invertebrates inhabiting immersed plants and plants with floating leaves, are described. Testing of the dredge during the collection of invertebrates on willowgrass and clasping-leaf and variable-leaved pondweed showed it to be portable and simple to use, effective from the waterline to maximum depths of plant growth, and capable of cutting even very thick plant stems. —Copyright (c) 1977, Biological Abstracts, Inc.
W77-12347

AN ACOUSTIC EMISSIONS MONITORING SYSTEM FOR AVALANCHE SNOWPACKS,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

For primary bibliographic entry see Field 2C.
W77-12368

NEW OXYGEN METERS.

For primary bibliographic entry see Field 5A.
W77-12399

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

A SURVEY OF COMMERCIALY AVAILABLE AUTOMATIC WASTEWATER SAMPLERS, Environmental Monitoring and Support Lab., Cincinnati, Ohio.
For primary bibliographic entry see Field 5A.
W77-12481

REMOTE SENSING OF SOIL MOISTURE.
For primary bibliographic entry see Field 2G.
W77-12516

LOW-COST DATA ANALYSIS SYSTEMS FOR PROCESSING MULTISPECTRAL SCANNER DATA, National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center. S. L. Whitely.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-12767. Price codes: A03 in paper copy, A01 in microfiche. Technical Report R-467, October 1976. 41 p, 12 fig, 1 tab, 3 ref, 2 append.

Descriptors: *Remote sensing, *Data processing, *Equipment, Analytical techniques, Photography, Color, Computers, Land use, Satellites(Artificial), Costs.
Identifiers: *Imaging techniques, Multispectral photography.

The basic hardware and software requirements were described for four low-cost analysis systems for computer-generated land use maps. The data analysis systems consist of an image display system, a small digital computer, and an output recording device. Software was described together with some of the display and recording devices, and typical costs were cited. Computer requirements were given, and two approaches were described for converting black-and-white film and electrostatic printer output to inexpensive printer output to inexpensive color output products. Examples of output products were shown. (Sims-ISWS)
W77-12549

AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR U.S. COAST GUARD AIRCRAFT POLLUTION PATROLS, Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 5A.
W77-12562

APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE COLORADO, Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W77-12567

THE USE OF AERIAL PHOTOGRAPHY IN THE STUDY OF WAVE CHARACTERISTICS IN THE COASTAL ZONE, Coastal Engineering Research Center, Fort Belvoir, Va. C. M. McClenan, and D. L. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A008 011. Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum No 48, January 1975. 72 p, 45 fig, 27 ref.

Descriptors: *Aerial photography, *Waves(Water), *Ocean waves, *Coasts, *Wavelengths, Refraction(Water waves), Breakwaters, Groins(Structures), Beaches, Topography, Currents(Water), Inlets(Waterways), Oceanography, *Remote sensing.
Identifiers: Breakers, Wave trains.

Aerial photos can provide information about the geometry of the ocean surface not readily obtainable in any other manner.

Photos reveal information about the number of wave trains present, the bending of wave crests due to refraction effects by both bottom topography and currents, and the existence of many nonlinear processes with regard to waves, some of which are rarely discussed in textbooks or oceanographic literature. Good aerial photos of waves show that multiple wave trains are common in the coastal zone. The relative importance of the various wave trains is changed by refraction and shoaling. The breakers, most prominent in the shore zone, often result from long, low swell, which is hardly discernable against the background of shorter waves a few hundred meters from shore. The generation of solutions and the regeneration of breakers which have crossed bars may lead to a breaker which is shorter than the period of the swell responsible for the breakers. Cylindrical waves radiating outward from rocks or shoals which penetrate the surface are formed from long-crested waves coming from the open sea. A wave pattern which appears random and chaotic when viewed at an elevation over 5,000 feet. This report discussed conditions which favor good aerial photos of waves and presented examples of many phenomena in wave behavior which are best seen from the perspective afforded by a high elevation. (Sims-ISWS)
W77-12573

AN AUTOMATIC SYSTEM FOR MEASURING SALT CONCENTRATION PROFILES IN POROUS MEDIA, Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-12619

SOIL SALINITY TESTING IN THE FIELD. Irrigation Journal, Vol 26, No 1, p 14-15, January-February 1976. 3 fig.

Descriptors: Salinity, *Saline soils, Electrical conductance, Electrodes, Measurement, *Testing, Instrumentation.
Identifiers: *Salinity testing devices.

One of the more important chores of an agricultural water manager treating saline soils is getting accurate information of the concentration and extent of soluble salts in such soils. Eyeballing crops and soils in such areas is not enough since salinity may reduce crop yields by as much as 25 percent without visible symptoms. The Agricultural Research Service's Salinity Laboratory in Riverside, California, has developed two devices that could make life easier for those charged with keeping salinity down to manageable levels. The devices may one day play a part in reducing or preventing farm income losses from salinity as well as aid in preventing environmental pollution. (Skogerboe-Colorado State)
W77-12720

BASIC PRINCIPLES FOR PROGNOSIS AND MONITORING OF SALINITY AND SODICITY, Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 2G.
W77-12766

TRACER MEASUREMENT OF RIVER EVAPORATION: LABORATORY STUDY, Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2D.
W77-12771

PRECIPITATION MAPPING WITH AN AIRBORNE SYNTHETIC APERTURE IMAGING RADAR, National Center for Atmospheric Research, Boulder, Colo.

For primary bibliographic entry see Field 2B.
W77-12804

ELECTRICAL METHODS OF DETERMINING SOIL MOISTURE CONTENT, Purdue Univ., LaFayette, Ind. Lab. for Applications of Remote Sensing.
For primary bibliographic entry see Field 2G.
W77-12818

AEROSPACE RESEARCH OF THE ENVIRONMENT. GEOBOTANY, SOIL SCIENCE, AND HYDROLOGY. Available from the National Technical Information Service, Springfield, VA 22161 as JPRS-66058. Price codes: A10 in paper copy, A01 in microfiche. Report JPRS 66058, Joint Publications Research Service, Arlington, Virginia, October 31, 1975. 212 p.

Descriptors: *Remote sensing, *Foreign research, *Satellites(Artificial), *Aerial photography, Vegetation, Soils, Soil science, Land use, Mapping, Agriculture, Surface waters, Glaciers, Glaciology, Snow cover, Radiation, Infrared radiation, Microwaves, Oceans, Oceanography.
Identifiers: *USSR.

The report contained papers of Soviet scientists attending the meeting of the Soviet-American Working Group on Investigation of the Natural Environment by Space Means held in Moscow 12-17 February 1973. This volume contained reports of Soviet scientists which were read at the meeting sections entitled 'Plant life, soils and land utilization,' 'Water, snow and glaciology,' 'Microwave technology,' and 'Oceanography.' The reports concerned the remote investigation of the subsurface in different ranges of the spectrum. Illustrations to the articles were contained at the back of the volume. The collection of reports will be of value to many specialists in different fields of research of the Earth's natural resources using aerospace techniques. (Sims-ISWS)
W77-12820

MEASURING SNOW COVER USING SATELLITE IMAGERY DURING 1973 AND 1974 MELT SEASON: NORTH SANTIAM, BOISE, AND UPPER SNAKE BASINS, Stanford Research Inst. Menlo Park, Calif.
For primary bibliographic entry see Field 2C.
W77-12821

7C. Evaluation, Processing and Publication

URBAN RUNOFF DIGITAL COMPUTER MODEL, Khonkaen Univ. (Thailand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-12316

THE WORLD'S HIGHEST DAMS, LARGEST EARTH AND ROCK DAMS, GREATEST MAN-MADE LAKES, LARGEST HYDROELECTRIC PLANTS, MAJOR DAMS, Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 8A.
W77-12327

UNITED STATES GEOLOGICAL SURVEY ANNUAL REPORT, FISCAL YEAR 1976. Geological Survey, Reston, Va.
For primary bibliographic entry see Field 9D.
W77-12369

WATER-LEVEL RECORDS FOR THE LOWER ARKANSAS RIVER VALLEY OF COLORADO, 1973-77.

Geological Survey, Denver, Colo. Water Resources Div.
R. D. Penley.
Open-file Report 77-560, July 1977. 49 p, 2 fig, 1 tab.

Descriptors: *Water wells, *Water levels, *Water level fluctuations, *Aquifers, *Colorado, Well data, Data collections, Measurement, Irrigation wells, Municipal water, Domestic water, Stock water.
Identifiers: *Southeastern Colorado, *Lower Arkansas River valley(Colo).

Water-level measurements made in more than 465 wells in March 1977 in the lower Arkansas River valley of southeastern Colorado are presented. Measurements for the preceding 4 years are included to serve as references illustrating declining or rising water levels. Changes in water levels from December 1975 to March 1977 ranged from a rise of 12.4 feet (3.8 meters) to a decline of 10.8 feet (3.3 meters). Water levels appear to be declining in the eastern part of the study area and stable to slightly rising in the western part. These data can be used by well owners for planning their irrigation schedules for the next irrigation season and can be used by water managers for developing plans to manage the ground-water resources. (Woodard-USGS)
W77-12370

WELL RECORDS, WATER-LEVEL MEASUREMENTS, LOGS OF TEST HOLES, AND CHEMICAL ANALYSES OF GROUND WATER IN THE CACHE RIVER ALLUVIAL AQUIFER-STREAM SYSTEM, NORTHEAST ARKANSAS, 1946-76.

Geological Survey, Little Rock, Ark. Water Resources Div.
P. W. Westerfield.
Open-file Report 77-402, May 1977. 166 p, 2 fig, 57 tab.

Descriptors: *Groundwater resources, *Alluvial aquifers, *Well data, *Water levels, *Water quality, Lithologic logs, Chemical analysis, Basic-data collections, Water utilization, Water yield.
Identifiers: *Northeast Arkansas, *Cache River alluvial aquifer-stream system.

Most of the ground-water data for the Cache River alluvial aquifer-stream system in northeast Arkansas were collected between March 1973 and April 1976, but some were collected as early as April 1946. The data includes records of 363 wells and test holes, water-level measurements of 295 wells, logs of 32 test holes, and chemical analyses of water samples from 85 wells. (Woodard-USGS)
W77-12371

THE NATIONAL WATER DATA EXCHANGE (NAWDEX).

Geological Survey, Reston, Va. Water Resources Div.
M. D. Edwards.
Open-file Report 77-259, 1977. 5 p.

Descriptors: *Data storage and retrieval, *Hydrologic data, *Information retrieval, *Information exchange, *Indexing, Publications, Bibliographies, Abstracts.
Identifiers: *National Water Data Exchange(NAWDEX), Data-search assistance, Data availability.

The National Water Data Exchange (NAWDEX) was established in 1976 to assist users of water data to identify, locate, and acquire needed data. NAWDEX is a confederation of water-oriented organizations working together to provide more timely and convenient access to their data. A directory of sources of water data and a nationwide index of available water data are maintained

for the storage and dissemination of information on available water data. Assistance services are provided through a nationwide network of Local Assistance Centers. This network consists of 51 Centers located in 45 states and Puerto Rico. The Centers provide convenient access to NAWDEX services as well as making local-area expertise available in the identification and location of needed data. Additional Centers will be added to the network, as needed, to meet demands. NAWDEX is centrally managed by a Program Office located within the U.S. Geological Survey's Water Resources Division in Reston, Virginia. (Woodard-USGS)
W77-12372

WATER-LEVEL RECORDS FOR ADAMS, LARIMER, LOGAN, MORGAN, SEDGWICK, WASHINGTON, AND WELD COUNTIES, COLORADO, 1973-77.

Geological Survey, Denver, Colo. Water Resources Div.
T. J. Major, and K. D. Vaughn.
Open-file Report 77-461, 1977. 19 p, 2 fig, 1 tab.

Descriptors: *Water wells, *Water levels, *Water level fluctuations, *Alluvial aquifers, *Colorado, Well data, Data collections, Measurement, Irrigation wells, Stock water.

Water levels measured during March 1977 in 350 wells tapping alluvial aquifers in Adams, Larimer, Logan, Morgan, Sedgwick, Washington, and Weld Counties, Colo., are presented. Water-level records for the 4 preceding years are included to serve as references illustrating declining or rising water levels. These data can be used by well owners for planning their irrigation schedules for the next irrigation season and can be used by water managers for developing plans to manage the ground-water resources. (Woodard-USGS)
W77-12373

TEMPERATURE OF MISSOURI STREAMS.

Geological Survey, Rolla, Mo. Water Resources Div.
J. E. Bowie.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 144. Price codes: A16 in paper copy, A01 in microfiche. Missouri Geological Survey and Water Resources, Rolla, 1971. 350 p.

Descriptors: *Water temperature, *Missouri, *Streams, *Discharge(Water), Measurement, Sites, Drainage area, Basic data collections.

Water temperatures measured in Missouri streams by the U.S. Geological Survey are tabulated to September 1969. Records are compiled in a downstream direction along the main stem and are identified by a nationwide identification number. Temperature is reported in degrees Fahrenheit, and the maximum observed temperature is given in the description for each station. A conversion table for converting degrees Fahrenheit to degrees Celsius is shown for the user's convenience. The drainage area is given in square miles. Stream discharge is reported in cubic feet per second. (Woodard-USGS)
W77-12385

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1976.

Geological Survey, Carson City, Nev. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 441. Price codes: A16 in paper copy, A01 in microfiche. Water-Data Report NV-76-1, February 1977. 344 p, 8 fig, 47 ref.

Descriptors: *Nevada, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes,

Reservoirs, Water wells, Water levels, Sediment transport, Chemical analysis, Sampling, Sites.

Water resources data for the 1976 water year for Nevada consist of records of discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 111 gaging stations; stage and contents for 21 lakes and reservoirs; water-quality data for continuing-record stations at 27 stream sites and for partial-record stations at 8 stream sites, 9 lake sites, and 14 wells; and water levels for 165 observation wells. Also included are 108 crest-stage partial-record stations and 13 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nevada. (Woodard-USGS)
W77-12386

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1976.

Geological Survey, University, Ala. Water Resources Div.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 689. Price codes: A16 in paper copy, A01 in microfiche. Water-Data Report AL-76-1, March 1977. 342 p, 7 fig.

Descriptors: *Alabama, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1976 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 88 gaging stations; stage only for 25 gaging stations, stage and contents for 12 lakes and reservoirs; water quality for 45 gaging stations and water levels for 53 observation wells. Also included are 27 crest-stage partial-record stations, 11 flood hydrograph partial-record stations, and 10 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (Woodard-USGS)
W77-12387

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1976.

Geological Survey, Columbia, S.C. Water Resources Div.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 413. Price codes: A11 in paper copy, A01 in microfiche. Water-Data Report SC-76-1, March 1977. 224 p, 4 fig, 32 ref.

Descriptors: *South Carolina, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Sampling, Sites.

Water resources data for the 1976 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 55 gaging stations;

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Group 7C—Evaluation, Processing and Publication

stage and contents for 11 lakes and reservoirs; water quality for 18 gaging stations and 5 ungaged stations; and water levels for 26 observation wells. Also included are 25 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Carolina. (Woodard-USGS)
W77-12388

WATER RESOURCES DATA FOR KENTUCKY, WATER YEAR 1976.
Geological Survey, Louisville, Ky. Water Resources Div.
Water-Data Report KY-76-1, February 1977. 477 p, 6 fig, 3 tab, 32 ref.

Descriptors: *Kentucky, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Water wells, Water levels, Sediment transport, Chemical analysis, Sampling, Sites.

Water resources data for the 1976 water year for Kentucky consist of records of stage, discharge, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs. This report contains discharge records for 128 gaging stations; stage and contents for 14 lakes; water quality for 54 gaging stations, 13 water-quality stations, 4 miscellaneous stations, and 33 wells and springs; and water levels for 36 observation wells. Also included are data for 119 crest-stage partial-record stations and 173 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kentucky. (Woodard-USGS)
W77-12389

HYDROGEOLOGIC DATA FROM INVESTIGATION OF WATER RESOURCES OF THE SOUTH FORK, SUFFOLK COUNTY, NEW YORK.
Geological Survey, Mineola, N.Y. Water Resources Div.
B. Nemickas, E. J. Koszalka, and D. E. Vaupel. Long Island Water Resources Bulletin LIWR-7, published by Suffolk County Water Authority, 1977. 31 p, 2 fig, 2 plates, 5 tab, 12 ref.

Descriptors: *Hydrologic data, *Groundwater resources, *Surface waters, *Water quality, *Aquifer characteristics, Hydrogeology, Water wells, Withdrawal, Water yield, Water supply, Chemical analysis.
Identifiers: *Long Island(NY), *South Fork(Long Island).

Water-quality analyses indicate that, with some exceptions, ground water and fresh surface water on the South Fork of Long Island, N.Y., is acceptable for drinking and most other uses. Total withdrawal for public supply in 1975 was about 2.57 million gallons per day. The upper glacial aquifer contributed 2.36 million gallons per day, and the Magothy aquifer, 0.21 million gallons per day. The hydrogeology of the South Fork of Long Island is briefly described, and a well-location map, lists of water-level measurements in 174 wells screened in the upper glacial aquifer, and a water-table map are included. Water-quality analyses from 51 of the wells and from 20 selected stream sites are presented. (Woodard-USGS)
W77-12390

SIMULATION PROCEDURE FOR MODELING TRANSIENT WATER-TABLE AND ARTESIAN STRESS AND RESPONSE.
Geological Survey, Little Rock, Ark. Water Resources Div.; and Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-12391

GROUNDWATER LEVELS IN NEBRASKA, 1976.
Geological Survey, Lincoln, Nebr. Water Resources Div.; and Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 4B.
W77-12393

WATER QUALITY MANAGEMENT—THE MANAGEMENT INFORMATION REQUIREMENT.
For primary bibliographic entry see Field 5G.
W77-12394

PERFORMANCE OF STORM DRAINAGE SIMULATION MODELS.
For primary bibliographic entry see Field 5D.
W77-12411

URBAN RUNOFF CHARACTERISTICS: VOLUME II—FIELD INVESTIGATIONS.
Cincinnati Univ., Ohio. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W77-12478

ROLE OF MODELS IN URBAN STORMWATER MANAGEMENT PLANNING.
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5G.
W77-12491

INVENTORY OF SEWAGE TREATMENT PLANTS FOR CHESAPEAKE BAY.
Chesapeake Research Consortium, Inc., Baltimore, Md.
For primary bibliographic entry see Field 5D.
W77-12496

COMPUTERIZED IRRIGATION SCHEDULING METHOD MAY SAVE FARMERS MILLIONS OF DOLLARS.
For primary bibliographic entry see Field 3F.
W77-12518

MINIMUM ENERGY DESIGNS FOR SELECTED IRRIGATION SYSTEMS.
Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12537

AN EMPIRICAL METHOD FOR SIMULATION OF WATER TABLES BY DIGITAL COMPUTERS.
Nevada Univ., Reno. Water Resources Center.
For primary bibliographic entry see Field 2F.
W77-12546

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME IV. OVERLAND FLOW ON AREAS SUBJECT TO INFILTRATION LOSSES.
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W77-12547

MARYLAND HIGHWAY DRAINAGE STUDY: VOLUME V. A DIMENSIONLESS HYDROGRAPH FOR ESTIMATING STORM RUNOFF FROM URBAN AREAS.
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W77-12548

LOW-COST DATA ANALYSIS SYSTEMS FOR PROCESSING MULTISPECTRAL SCANNER DATA.
National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.
For primary bibliographic entry see Field 7B.
W77-12549

AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR U.S. COAST GUARD AIRCRAFT POLLUTION PATROLS.
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 5A.
W77-12562

FLOOD PLAIN INFORMATION: RIO SAN JOSE, PUEBLO OF LAGUNA, NEW MEXICO.
Army Engineer District, Albuquerque, N. Mex.
For primary bibliographic entry see Field 4A.
W77-12593

FLOOD PLAIN INFORMATION: ONEIDA CREEK, NEW YORK.
Army Engineer District, Buffalo, N.Y.
For primary bibliographic entry see Field 4A.
W77-12594

FLOOD PLAIN INFORMATION: COLORADO RIVER AND COUNTRY CLUB CREEK, AUSTIN, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-12595

FLOOD PLAIN INFORMATION: KIRKWOOD BRANCH AND DOVE CREEK, SOUTHLAKE, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-12596

FLOOD PLAIN INFORMATION: CANEY CREEK, MONTGOMERY COUNTY, TEXAS.
Army Engineer District, Galveston, Tex.
For primary bibliographic entry see Field 4A.
W77-12597

FLOOD PLAIN INFORMATION: COLLINS RIVER, BARREN FORK, HICKORY AND CHARLES CREEKS, MCMINNVILLE, TENNESSEE.
Army Engineer District, Nashville, Tenn.
For primary bibliographic entry see Field 4A.
W77-12598

FLOOD PLAIN INFORMATION: BROOKINGS, BROOKINGS COUNTY, SOUTH DAKOTA, VOLUME II, SIX MILE CREEK.
Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W77-12599

FLOOD PLAIN INFORMATION: SOUTHWEST STREAM GROUP, STOCKTON, CALIFORNIA.
Army Engineer District, Sacramento, Calif.
For primary bibliographic entry see Field 4A.
W77-12600

FLOOD PLAIN INFORMATION: WILLOW RIVER AND PAPERJACK CREEK, NEW RICHMOND, WISCONSIN.
Army Engineer District, St. Paul, Minn.
For primary bibliographic entry see Field 4A.
W77-12601

FLOOD PLAIN INFORMATION: WISCONSIN RIVER, COLUMBIA AND SAUK COUNTIES, WISCONSIN.
Army Engineer District, St. Paul, Minn.
For primary bibliographic entry see Field 4A.
W77-12602

FLOOD PLAIN INFORMATION: DORCHESTER, WHITMAN, QUESET, BLACK, BEAVER, POQUANTICUT, MULBERRY AND GOWARDS BROOKS, EASTON, MAS-SACHUSETTS.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12603

FLOOD PLAIN INFORMATION: LITTLE ANDROSCOGGIN RIVER: AUBURN, POLAND, MECHANIC FALLS, AND MINOT, MAINE.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12604

FLOOD PLAIN INFORMATION: MILLERS RIVER AND NORTH BRANCH: WINCHENDON, MASSACHUSETTS.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12605

FLOOD PLAIN INFORMATION: WEST RIVER AND UTLEY BROOK: WESTON-LONDONDERY, VERMONT.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-12606

OPTIMIZATION OF WATER USE FOR IRRIGATION.
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-12617

INFORMATION STORAGE AND RETRIEVAL FOR EVALUATION OF IRRIGATION POTENTIAL.
Alabama Agricultural Experiment Station, Auburn.
E. W. Rochester, J. A. McGuire, and J. L. Stallings.

Descriptors: Computers, *Information storage and retrieval, Alabama, *Crop production, Soils, Climate, *Irrigation, Evaluation.

A computerized information storage and retrieval system is being developed in Alabama. The system called ARIS, is based on commercially available software and makes available numerical data about the resources of the State. Included in the utilization of ARIS is the evaluation of irrigation potential. Data describing soils, climate, water and crops are being encoded for this evaluation. (Skogerboe-Colorado State)
W77-12723

MAP OF SALTY SOILS OF AFRICA.
Office de la Recherche Scientifique et Technique Outre-Mer Bondy (France).
For primary bibliographic entry see Field 2G.
W77-12765

SALINE WATER CLASSIFICATION IN IRAN BY RATIONAL METHODS.
Tehran Univ., Karaj (Iran). Dept. of Soil Science.
For primary bibliographic entry see Field 3C.
W77-12768

FIELD TESTING OF A NEW SYSTEM FOR QUALIFYING IRRIGATION WATER.
Instituto de Edafologia, Maracay (Venezuela).
For primary bibliographic entry see Field 3C.
W77-12769

FLOOD RISK MAP, CARMAN, MANITOBA.
Department of Mines, Resources and Environmental Management, Winnipeg (Manitoba). Water Resources Div.
Inland Waters Directorate, Fisheries and Environment Canada, Ottawa, Canada; Department of Energy, Mines and Resources, Ottawa, Canada, 1977. 21 p., 4 fig., 1 map. (In English and French).

Descriptors: *Flood control, *Flood data, *Flood discharge, *Flood flow, *Flood forecasting, Flood frequency, Flood irrigation, Flood peak, Flood plains, Flood protection, Flood recurrence intervals, Flood profiles, Risks, Mapping, Graphical analysis, *Canada.
Identifiers: *Carman(Canada), Manitoba, *Boyne River(Canada).

Carman is typical of small urban communities in Manitoba which have developed on flood plains. Normally flow on the Boyne River is well within its banks and dams are required to provide a continuous water supply for domestic and municipal use. However, during spring runoff floods are occasionally experienced. The gross drainage area of the Boyne River at the Town of Carman is 460 square miles. The amount and rate of runoff are affected by antecedent moisture conditions, amount of precipitation prior to and during runoff, rate of snow melt and the coincidence of high tributary and main channel flows. When one or more of these factors is above normal, flood flows may result causing significant damage particularly within the Town of Carman. Ice jams have also caused or aggravated flooding. (WATDOC)
W77-12770

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965 - 1974, NO. 2. PLACE GLACIER, BRITISH COLUMBIA - SUMMARY OF MEASUREMENTS.
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
For primary bibliographic entry see Field 2C.
W77-12788

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965 - 1974, NO. 3. RAM RIVER GLACIER, ALBERTA - SUMMARY OF MEASUREMENTS.
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 2C.
W77-12789

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965-1974, NO. 4. PEYTO GLACIER, ALBERTA - SUMMARY OF MEASUREMENTS.
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 2C.
W77-12790

STORM WATER MANAGEMENT MODEL STUDY, VOLUME III, USER'S MANUAL.
Proctor and Redfern Ltd., Toronto (Ontario); and McLaren (James F.) Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 5B.

W77-12792

HYDROLOGIC STUDY OF ILLINOIS BEACH STATE PARK.
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2A.
W77-12793

PRECIPITATION MAPPING WITH AN AIRBORNE SYNTHETIC APERTURE IMAGING RADAR.
National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 2B.
W77-12804

MEASURING SNOW COVER USING SATELLITE IMAGERY DURING 1973 AND 1974 MELT SEASON: NORTH SANTIAM, BOISE, AND UPPER SNAKE BASINS.
Stanford Research Inst. Menlo Park, Calif.
For primary bibliographic entry see Field 2C.
W77-12821

A PACKAGE OF COMPUTER PROGRAMS FOR BENTHIC COMMUNITY ANALYSIS.
Florida Univ., Gainesville. Dept. of Zoology. S. A. Bloom, S. L. Santos, and J. G. Field.
Bulletin of Marine Science, Vol. 27, No. 3, p 577-580, 1977. 1 tab, 16 ref.

Descriptors: *Data collections, *Data processing, *Computer programs, *Computers, *Biological communities, *Analysis, Benthos, Programs, Data storage and retrieval, Systems analysis, Methodology.
Identifiers: *Benthic community analysis, Marine ecological analysis.

A package of computer programs which can sort and transfer benthic community organismal data, aid the analysis of sedimentary data, calculate a nonparametric correlation statistic, and perform a series of multivariate techniques (ordination and classification) including plotting of the results was described. The programs were written in FORTRAN IV for use on an IBM 360/370 computer. (Katz)
W77-12850

UPPER BAY SURVEY, VOL. III. AUTOMATED DATA PROCESSING AND SUPPLEMENTARY DATA.
Westinghouse Electrical Corp., Annapolis, Md. Oceanic Div.
For primary bibliographic entry see Field 5A.
W77-12881

THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 8. COMPUTER MODELS FOR ENVIRONMENTAL ENGINEERING AND RESEARCH IN NEAR-COASTAL ENVIRONMENTS.
Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
For primary bibliographic entry see Field 2L.
W77-12916

CONCEPTUAL DESIGN OF A COMPUTER SYSTEM TO SUPPORT THE OPERATIONS OF THE SUBMERGED LANDS SECTION UNDER ACT 247 AND ACT 346.
American Management Systems, Inc., Arlington, Va.; and Michigan Dept. of Natural Resources, Lansing. Bureau of Water Management.
Report to Michigan Department of Natural Resources, The Water Management Division, June 8, 1977. 96 p., 11 exhibits, 5 append.

Descriptors: *Coasts, *Computer programs, Water resources, Resources development, *Michigan.

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

Identifiers: *Coastal zone management, Submerged lands.

The conceptual design of a computer system which will increase the efficiency and effectiveness of the operations of the Submerged Lands Section by automating several functions which are currently performed manually is presented. The development of the system will be conducted in four phases: Phase I: System Concept, Phase II: General Design, Phase III: Detail Design, and Phase IV: Implementation. The Submerged Lands Section is responsible for issuing permits for dredging, filling, construction and other similar types of projects affecting bottomland in coastal and inland waters; and for issuing operating permits to marinas. (NOAA)
W77-12961

8. ENGINEERING WORKS

8A. Structures

THE WORLD'S HIGHEST DAMS, LARGEST EARTH AND ROCK DAMS, GREATEST MAN-MADE LAKES, LARGEST HYDROELECTRIC PLANTS, MAJOR DAMS,
Bureau of Reclamation, Washington, D.C.
T. W. Mermel.
September 1975. 5 p, 5 tab. Nu Rec 5-01-44-00294.

Descriptors: *Dams, *Earth dams, *Rockfill dams, *Lakes, *Hydroelectric plants, Dimensions, Size, Data collections.
Identifiers: *Man-made lakes.

This report consisted of 5 tables. Dimensions, type, capacity, and date of operation information was included for the structures mentioned in the title. The first 25 each of the world's highest dams, of the world's largest dams, and the world's greatest man-made lakes are listed. In addition, the characteristics of 101 of the world's largest hydroelectric plants are described; and the 160 major world dams are included. (Froehlich-ISWS)
W77-12327

DRAINAGE PROGRESS AND PROBLEMS ON THE COLUMBIA BASIN PROJECT,
Bureau of Reclamation, Othello, Wash.
C. A. Neumann.
Presented at the 1976 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1976, Chicago, Illinois. 10 p, 5 ref.

Descriptors: Drainage districts, Drainage effects, *Drainage practices, Drainage programs, Drains, *Columbia River, Drainage engineering, Drainage water, River basins.

Construction has been completed for approximately 4,757 kilometers (2,956 miles) of agricultural drains and outlet channels on the Columbia Basin Project. Some of the recent advances and problems associated with drain construction on the Project are discussed. (Skogerboe-Colorado State)
W77-12618

APPARATUS FOR GENERATING ELECTRICITY AND POWER FROM NATURAL WATER FLOW,
W. L. Chappell.
U.S. Patent No 4,023,041, 6 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 958, to 2, p 833, May 10, 1977.

Descriptors: *Patents, *Flow, *Stream flow, *Currents(Water), *Tides, *Waves(Water), Electric power production, Tidal powerplants.

A new and improved apparatus for converting the natural movement of a body of water into

mechanical energy for generating electricity and power includes a generator platform having floating barges with paddle wheel assemblies and mounted with pivot axes to permit the barges to freely rotate 360 degrees about the axes in response to changes in the direction of water movement and to permit up and down movement of the barges in response to changes in the water level. The pivot axes may be mounted with the floor of the body of water or with the platform and the platform may be secured with the floor or may be a floating platform. (Sinha-OEIS)
W77-12705

INTERFACE BETWEEN TWO DISSIMILAR FLUIDS BENEATH A SHEETPILE COFFERDAM,
Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-12807

8B. Hydraulics

A LABORATORY STUDY OF WASTE INJECTION INTO A GHYBENHERZBERG GROUNDWATER SYSTEM UNDER DYNAMIC CONDITIONS,
Hawaii Univ., Honolulu. Water Resources Research Center.
D. L. Heutmaker, F. L. Peterson, and S. W. Wheatcraft.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 718, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 107, March 1977. 65 p. OWRT B-043-HI(1), 14-31-0001-3511.

Descriptors: *Waste disposal, *Injection, Groundwater, Hydrogeology, Hydrodynamics, Geochemistry, *Hawaii, Hydraulic models, Fluid mechanics, Effluents, Injection wells.
Identifiers: Sandbox model.

A laboratory sand-packed hydraulic model was used to study the mechanics of buoyant plume movement, and the entrainment of salt water by the plume. Simulated waste effluent was injected into a density-stratified aquifer system under dynamic groundwater conditions, and the effects on plume mechanics of varying several different injection parameters, such as injection depth and rate, type of injection source, strength of the ambient flow field, and density of ambient receiving water, were observed. In every experiment conducted during this study, a buoyant plume of injected effluent, which was clearly distinct from the resident aquifer liquids, formed and rose vertically into the lower portion of the freshwater lens, where it was subjected to the freshwater flow field and migrated downgradient with the fresh water, still keeping its identity as a distinct plume of injected effluent. Three of the injection parameters exerted significant control on the movement of the injection plumes. The rate of effluent injection and the strength of the ambient freshwater flow field significantly influenced both the vertical and up-gradient dimensions of the plumes, and also appeared to influence downgradient mixing of the plume with the ambient fresh water; and the depth of effluent injection, with respect to the relative density of the resident liquids, influenced the up-gradient migration of the plumes. Although there was some initial evidence of salt water entrainment within the salt zone injection plumes, it was transient phenomenon, and little evidence of salt water entrainment was observed once the plumes reached steady-state conditions. Downgradient dilution of the effluent plumes by the ambient fresh water was apparent, however, and increased with downgradient distance from the injection well.
W77-12267

EFFECT OF OPENINGS ON INFLOW INTO CORRUGATED DRAINS,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
N. J. Bravo, and G. O. Schwab.
Transactions of the American Society of Agricultural Engineers, Vol. 20, No. 1, p 100-104, January-February 1977. 6 fig, 3 tab, 11 ref.

Descriptors: *Drains, *Inflow, *Analog models, *Orifices, Plastic pipes, Mathematical models, Saturated flow, Laplace equation, Boundaries(Surfaces), Groundwater potential, Hydraulic conductivity, Flow, Soil water movement.
Identifiers: Radial flow, Corrugated drains, Slots.

The relative effectiveness of the openings in corrugated plastic drains as influenced by the presence of soil within the corrugations and within the openings themselves was evaluated from the standpoint of water inflow for saturated conditions in a homogeneous, isotropic soil. Electrical analog models provided empirical estimates of the relative flow into drain openings as well as the boundary conditions for mathematical models. Three-dimensional mathematical models were based on Laplace's equation with appropriate boundary conditions. After agreement between the analog and mathematical models was established for simple configurations, inflow for the more complicated cases was measured with electric analog models. (Visocky-ISWS)
W77-12305

URBAN RUNOFF DIGITAL COMPUTER MODEL,
Khonkaen Univ. (Thailand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-12316

PREDICTION OF LONGITUDINAL DISPERSION IN NATURAL STREAMS,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2E.
W77-12330

EFFECTS OF TOW TRAFFIC ON THE RESUSPENSION OF SEDIMENTS AND ON DISSOLVED OXYGEN CONCENTRATIONS IN THE ILLINOIS AND UPPER MISSISSIPPI RIVERS UNDER NORMAL POOL CONDITIONS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Engineering Effects Lab.
For primary bibliographic entry see Field 5C.
W77-12331

PRESSURIZED PIPELINE TRANSPORT OF EFFLUENT SEDIMENTS (K VOPROSU PEREKACHKI OSADKOV STOCHNYKH VOD PO NAPORNYM TRUBOPROVODAM),
For primary bibliographic entry see Field 5D.
W77-12356

INITIAL DILUTION WITH DEEPWATER DIFFUSERS,
Caldwell Connell Engineers, Melbourne (Australia).
For primary bibliographic entry see Field 5E.
W77-12408

DRAG REDUCTION IN TURBULENT FLOW OF POLYMER SOLUTIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
E. W. Merrill, K. A. Smith, and R. C. Armstrong.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A017 105, Price codes: A07 in paper copy, A01 in microfiche. Report CED-DR-75-2, October 24,

1975. 147 p, 58 fig, 13 tab, 6 append. ONR N00014-67-A0204-0037.

Descriptors: *Turbulent flow, *Flow resistance, *Non-Newtonian flow, *Polymers, *Fluid friction, *Polyelectrolytes, Reynolds number, Laboratory tests, Theoretical analysis, Rheology, Viscosity, Drag, Organic compounds.
Identifiers: *Drag reduction, Extensional flow, Monodisperse polymers, Friction factors.

Polyelectrolytes as drag reducing agents were studied; abnormal effects occurred only in dilute aqueous solutions free of added electrolyte. Extensional flows of polyisobutylene observed by light scattering indicate greater elongation than in shear flow, but work is unfinished. Onset of drag reduction studied with 'monodisperse' poly cis isoprene solutions indicate time based hypothesis gives better correlation than length based hypothesis and that there may be two different onset levels. (Adams-ISWS)
W77-12541

SURF OBSERVATIONS AND LONGSHORE CURRENT PREDICTION,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.
W77-12560

TIME SCALE AND MOLECULAR WEIGHT DISTRIBUTION CONTRIBUTIONS TO DILUTE POLYMER SOLUTION FLUID MECHANICS,
Pennsylvania State Univ., University Park. Applied Research Lab.
N. S. Berman, and W. K. George.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A011 091. Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum, Naval Ordnance Systems Command, File No. TM 74-34, February 19, 1974. 18 p, 8 fig, 2 tab, 13 ref. Navy N00017-73-C-1418.

Descriptors: *Polymers, *Fluid mechanics, *Model studies, Mathematical models, Laboratory tests, Drag, Flow, Pipes, *Pipe flow, Flow characteristics, Flow friction, Hydrodynamics, Hydraulics, Aqueous solutions, Viscosity.

Experimental results on drag reduction in pipe flow, pitot tube errors and polymer degradation are presented to support a thickened sublayer model for dilute polymer solutions. The proposed model exhibits onset when the flow time scale equals the polymer time scale and increased drag reduction, degradation or pitot tube error as increased fractions of the polymers in the distribution are stretched by the flow. Eventually a limit is reached when the measure of increased sublayer thickness or increased effective viscosity in a pipe flow core, $c(\eta)$, reaches a limit due to entanglement of stretched molecules. The model correlates well with the experimental data. (Sims-ISWS)
W77-12564

DESIGN WAVE INFORMATION FOR THE GREAT LAKES; REPORT 2, LAKE ONTARIO,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
D. T. Resio, and C. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-023 210. Price codes: A07 in paper copy, A01 in microfiche. Technical Report H-76-1, March 1976. 133 p, 37 fig, 8 tab, 67 ref, 6 append.

Descriptors: *Waves(Water), *Lake Ontario, *Great Lakes, Tropical cyclones, Extratropical cyclones, Winds, Boundary layers, Wind velocity, Mathematical models, Equations.
Identifiers: *Wave data, *Design waves, Wave models, Wind-generated waves, Wave spectra, Wind phenomena, Spectral wave components.

Hindcast wave information that is applicable to many planning and design purposes on Lake Ontario was presented. Historical wind data from three stations located along Lake Ontario served as input to the numerical hindcast model, and significant wave heights were calculated for 5-, 10-, 50-, and 100-year return periods. These results were provided in tabular form for 17 points along the Lake Ontario shoreline. The mean significant period for each of these wave heights also was given. Information was provided for four seasons of the year and was separated into three approach directions relative to shore. The primary purpose of the study was to provide wave information for planned sites of dredge material retaining structures on the Great Lakes. Secondary goals were the provision of wind-field information over the Great Lakes and detailed wave information along U.S. shorelines of the Lakes. (Roberts-ISWS)
W77-12569

WELL REDEVELOPMENT: PART 1,
National Water Well Association, Worthington, Ohio.
T. E. Gass.
Water Well Journal, Vol. 31, No. 9, p 40-42, September, 1977. 1 fig.

Descriptors: *Water wells, *Rehabilitation, *Maintenance, *Acids, *Chemical precipitation, Calcium carbonate, Iron, Iron bacteria, Well screens.
Identifiers: *Incrustation, *Well redevelopment, Muriatic acid, Sulfamic acid, Hydroxyacetic acid.

Proper well redevelopment can increase productivity, minimize energy requirements and costs for pumping, and reduce excessive drawdown of the water table in the vicinity of a well. Most wells producing at 50% or better original design capacity can be restored to produce up to 95% original capacity with proper redevelopment. Incrustation, the most common cause of decrease in specific capacity, results when chemical equilibrium of ground water is disrupted by reduction of head due to drawdown of a pumping well. Chemical precipitation of iron and carbonates clogs the well screen and casing perforations as well as formation pores. Presence of iron bacteria may compound such problems. Acid treatment is the most prevalent treatment method for eliminating chemical precipitation. Muriatic (hydrochloric) acid and sulfuric acid are common in such treatments. Placing the acid directly in the well and providing some sort of mechanical agitation will generally break up incrusting deposits. Hydroxyacetic acid is also frequently used on wells with iron incrustation or iron bacteria problems, and is relatively non-corrosive. (Eberle-NWWA)
W77-12673

TWO-PHASE, TWO-DIMENSIONAL SIMULATION OF A GEOTHERMAL RESERVOIR,
Chevron Oil Field Research Co., La Habra, Calif.
For primary bibliographic entry see Field 2F.
W77-12674

WATER WELL JOURNAL FUNDS HEAT PUMP RESEARCH.
For primary bibliographic entry see Field 8C.
W77-12676

COMPOSITE WELL SYSTEMS,
National Water Well Association, Worthington, Ohio.
T. E. Gass.
Water Well Journal, Vol 31, No 8, p 38-39, August, 1977. 4 fig, 7 ref.

Descriptors: *Water wells, *Drawdown, *Well spacing, Recharge, Water levels, Aquifers, Transmissivity.
Identifiers: *Composite well systems, Interference.

A composite well system consists of a group of small-diameter wells arranged in pattern such that together they discharge the same quantity as a single large-diameter well. Composite systems can often be constructed more economically and conveniently than one large well; though the most generally desirable arrangement for a composite well field in an extensive aquifer is equal spacing of wells on the circumference of a circle, patterns can be varied to take greatest advantage of local hydrological characteristics. It is usually advisable to space wells at a distance equal to twice the saturated thickness of the aquifer when the aquifer is 100 feet thick or less. Economic considerations favor composite well installations where transmissivity varies both with the thickness and permeability of the aquifer, or in thin, low permeability aquifers under water table conditions. (Eberle-NWWA)
W77-12678

RECOVERY OF ENERGY FROM FRACTURE-STIMULATED GEOTHERMAL RESERVOIRS,
Stanford Univ., Calif.
For primary bibliographic entry see Field 8E.
W77-12680

PUMPING TESTS PROVIDE USEFUL DATA: PART 3,
Universal Oil Products, St. Paul, Minn. Johnson Div.
For primary bibliographic entry see Field 8G.
W77-12683

ENERGY ECONOMICS IN PIPE AND SYSTEM SELECTION,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 3F.
W77-12715

VENTURI FLUMES FOR CIRCULAR CHANNELS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
M. H. Diskin.
Journal of the Irrigation and Drainage Division, Proceedings of the ASCE, Vol 102, No IR3, p 383-387, September 1976. 4 fig, 1 tab, 6 ref.

Descriptors: Flumes, *Flow measurement, Flow rates, *Venturi flumes, *Open channel flow, Measurement, Irrigation.
Identifiers: Circular channels.

The principle of operation and the advantages of Venturi flumes for open-channel flow measurements are well known and amply documented in technical literature dealing with flow measuring methods. The main advantages are the ability to adapt the shape of the flume to the shape of the channel and to the range of flows expected, the possibility of predicting the coefficients of discharge either by theoretical considerations or from results of calibration tests, and finally the relatively small head losses possible with Venturi flumes as evident by the high values of allowable submergence. Some experimental results are presented for Venturi flumes. While these designs may be used also as Venturimeters for full pipe flow, the results refer only to open-channel flow at a mild slope. The results are not applicable to steep channels where the flow is supercritical and a jump forms a short distance upstream of the flume. Information about the limiting submergence of the flumes tested is also presented. (Skogerboe-Colorado State)
W77-12721

HYDRAULIC CHARACTERISTICS OF IRRIGATION FURROWS,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
M. K. Ramsey, and D. D. Fangmeier.

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

Paper No 76-2046, Presented at the Annual Meeting of the American Society of Civil Engineers, June 27-30, 1976, Lincoln, Nebraska, 17 p, 4 fig, 5 ref.

Descriptors: Infiltration, *Furrow irrigation, *Furrows, *Furrow systems, Irrigation systems, Irrigation effects, Hydraulics, Flow measurement. Identifiers: *Furrow geometry.

Seven irrigations were conducted on a precision field furrow. Inflow, outflow, water surface elevations, soil surface elevations, and furrow geometry were measured. Methods of determination and comparisons of infiltration functions, effect of flow depth on intake, and flow resistance parameters are presented. (Skogerboe-Colorado State) W77-12722

INTERFACE BETWEEN TWO DISSIMILAR FLUIDS BENEATH A SHEETPILE COFFERDAM. Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.

A. S. Reddy, and U. Basu. Water Resources Bulletin, Vol. 13, No. 4, p 735-745, August 1977. 4 fig, 14 ref.

Descriptors: *Cofferdams, *Sheet piling, *Interfaces, Model studies, Mathematical models, Seepage, Density, Porous media, Homogeneity, Isotropy, Mathematics, Equations, Hydraulic structures, Dams, Civil engineering.

A closed form solution was presented for determining the shape and location of the interface between two dissimilar fluids (having different densities) when steady flow takes place through a homogeneous and isotropic porous medium into a sheetpile cofferdam; the interface was assumed to be sharp and the lower fluid was assumed to be stationary. The solution was obtained using the inverse hodograph. Numerical results were presented in nondimensional form for various parametric conditions in the physical plane; the interface pattern, the seepage discharge, and exit gradient distribution were shown. The critical conditions of the interface were studied. (Sims-ISWS) W77-12807

APPLICATION OF A 'RADIATION-TYPE' BOUNDARY CONDITION TO THE WAVE-POROUS PROBLEM. North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.

For primary bibliographic entry see Field 2L. W77-12911

8C. Hydraulic Machinery

THE WORLD'S HIGHEST DAMS, LARGEST EARTH AND ROCK DAMS, GREATEST MAN-MADE LAKES, LARGEST HYDROELECTRIC PLANTS, MAJOR DAMS. Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 8A. W77-12327

CONTROL FUNCTIONS AT COPPERMILLS WORKS.

For primary bibliographic entry see Field 5D. W77-12433

IMPELLER DESIGN KEEPS DOWN PUMP SET MAINTENANCE.

Surveyor, Vol 150, No 4440, p 29, July, 1977.

Descriptors: *Centrifugal pumps, *Centrifugation, *Design, *Impellers, *Pumps, Sewage treatment, Operation and maintenance, Sludge treatment, Gases, Equipment, Waste water treatment.

KSB Manufacturing Company Limited in London is marketing a series of centrifugal pumps equipped with single vane or free-flow impellers which allow unconstrained passage from the suction to the discharge end of the pump. Clumping of long-fiber constituents does not hinder pump operation with the single vane impeller. Balance vanes at the front and back of the impeller prevent solid matter from entering into and around the sides of the impeller and stuffing box. A radial vane free-flow impeller for use with gaseous sludges is recessed into the back of the pump casing. Horizontal and vertical impellers, renewable wear plates, interchangeable parts, and a back pull-out design with horizontal pumps are available. Horizontal impellers are able to handle 3,000 cu m/hr and vertical impellers 1,250 cu m/hr. (Schulz-FIRL) W77-12439

GAS TURBINE GEN-SETS FOR SEWAGE TREATMENT STANDBY.

For primary bibliographic entry see Field 5D. W77-12442

SEWER RENOVATION TECHNIQUES.

Surveyor, Vol. 150, No. 4440, p 15-16, July, 1977.

Descriptors: *Sewers, *Pipes, *Repairing, *Maintenance, *Plastic pipes, Cast-in-place structures, Concrete pipes, Pipelines, Infiltration, Resins, Grouting, Cement grouting, Chemical grouting, Construction materials, Sealants. Identifiers: *Sewer rehabilitation, Slip liners.

Methods of sewer rehabilitation in England which save replacement costs are reviewed. Mortar repointing for old brick sewers is described. Chemical grouting can be used to stabilize soil, fill voids around the sewer pipe, and seal small cracks or leaking joints. A chemical grout injection system developed by the American Cyanamid Company is described. Grouting equipment is positioned with the aid of closed-circuit television and a pneumatic packing device is used to isolate the section for repair. The use of waterproofing and sealing compounds is described as another method of nonstructural sewer repair. Structural renovation methods which involve laying another pipe within an existing sewer are described. Slip-lining with polyethylene pipe can be used to renovate non-man-entry sewers. Pre-shot segmented sections of Gunit concrete or Gunit spray application can be used in man-entry sewers. Reduction in sewer size with lining impacement is considered as a limiting factor on structural renovation methods. Panelling with glass-reinforced cement or glass-reinforced plastics is considered. Panels can be installed without flow interruption, replaced individually, and preformed to the sewer profile. (Schulz-FIRL) W77-12449

THE CONSTRUCTION OF THE FIRST PHASE OF THE MODERNISATION OF SHIELDHALL SEWAGE WORKS IN GLASGOW.

Fairhurst (W. A.) and Partners, Glasgow (Scotland). For primary bibliographic entry see Field 5D. W77-12450

REMOVAL OF SLUDGE FROM WASTE WATER TREATMENT PLANT-BY ROTARY SWEEP FOOTBRIDGE WITH INBUILT SUCTION SCRAPER.

For primary bibliographic entry see Field 5D. W77-12457

SURGE ARRESTOR CONTROLS FLORIDA SEWAGE.

Water and Wastes Engineering, Vol. 14, No. 7, p 55, July, 1977.

Descriptors: *Sewerage, *Pipes, Flow, Equipment, *Pressure, Sewers, Hydraulic structures, Waste water treatment. Identifiers: Pinellas County(FL), St. Petersburg(FL), Tampa Bay(FL).

The Boca Ciega Cross State Sewage Transmission System, servicing the St. Petersburg/Tampa Bay area in Pinellas County, Florida, has begun using a hydro-pneumatic surge arrestor to control pressure fluctuations and prevent rupture of thin-walled sewer piping from the shock pressures of pump start-up and shutdown. The vented surge arrestor, furnished by Greer Hydraulics, Inc., is designed to limit maximum surge pressure at the Lake Seminole master lift station to 83 psig, thereby controlling shock pressures in the system's 14,000 feet of thin-walled piping. (Schulz-FIRL) W77-12462

NORTH EAST SEWERAGE SCHEMES, PUMP CONTRACTS.

Water Services, Vol. 81, No. 976, p 368, June, 1977.

Descriptors: *Treatment facilities, *Pumping plants, *Interceptor sewers, *Sewage treatment, *Pumps, Sewerage, Waste water treatment. Identifiers: *Northumbrian Water Authority(UK), Sunderland(UK), Browns Point(UK).

The Northumbrian Water Authority in England has awarded two contracts to Sigmund Pulsometer Projects Ltd. for the supply and installation of pumping equipment at Browns Point, Whitley Bay and for construction of a new sewage treatment plant at Sunderland. The Browns Point pumping station will contain three Hidrostral vertical pump sets, three disintegrator pumps, a submersible pump, and a washwater booster unit. The Sunderland sewage works will be used for sewage treatment prior to ocean discharge of effluent. (Schulz-FIRL) W77-12463

FEASIBILITY OF USING SOLAR ENERGY TO DRIVE IRRIGATION PUMPS.

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering. For primary bibliographic entry see Field 3F. W77-12513

LINE POWER VARIATIONS CAUSE PUMP MOTOR PROBLEMS.

C. R. Saylor. Ground Water Age, Vol. 11, No. 8, p 27-32, p 53-54, April, 1977. 4 fig.

Descriptors: *Pumps, *Electric motors, *Electric currents, Electric power, Electric insulation, Frequency, Damages. Identifiers: *Voltage fluctuation, Power factor, Torque, Motor slip.

With the present trend toward energy cutbacks and increasingly frequent brownouts, it is becoming more and more essential to anticipate line power variations which will reach pump motor terminals. Chronic low voltage can quickly lead to overheating and subsequent pump failure. Although standard motors will operate successfully under running conditions at rated load with a plus or minus 10% variation in voltage at rated frequency, a motor may not be able to start and accelerate normal loads at low voltage. Among the factors to be considered in assessing a pump motor's applicability to a given situation are (1) power factor variance with respect to change in voltage (2) speed of motor and motor slip as related to voltage variance (3) voltage imbalance in polyphase motors. In certain situations 60 Hertz motors can be operated at 50 Hertz. Various adjustments in applied voltage and horsepower load, however, need to be made in order to insure safe operation under such conditions. (Eberle-NWWA)

W77-12666

DRILLING RESEARCH TO PAY OFF BY 2000, Maurer Engineering Inc., Houston, Tex. W. C. Maurer. Oil and Gas Journal, Vol. 75, No. 35, p 179-200, August, 1977. 40 fig, 23 ref.

Descriptors: *Drilling, *Drilling equipment, *Telemetry, Logging(Recording), Borehole geophysics. Identifiers: *Downhole motors, *Novel drilling techniques, Turbodrills, Moineau motors, Mud pulse telemetry, Electromagnetic telemetry, Acoustic telemetry, High-pressure erosion drilling.

Considerable research in drilling is now underway that is expected to change dramatically techniques of making hole in the next decade. Extensive work has been and is being done on down-hole drilling motors (vane, Moineau, and Turbodrill types), borehole data telemetry systems (mud pulse, wire, acoustic, and electromagnetic), high pressure erosion drills, and 'novel' drills (melting and vaporization, thermal spalling, chemical, and mechanical breakage types). Down-hole motors for routine drilling are in the prototype stage and should come into extensive use by 1982. Borehole telemetry should be available by 1979, with wide use perhaps as early as 1983. High pressure bits could become popular within the next eight years, however, novel drilling methods are unlikely to contribute much to total footage before 1990. (Eberle-NWVA) W77-12668

INGENUITY SPARKS DRILLING HISTORY, Petroleum Publishing Co., Tulsa, Okla. For primary bibliographic entry see Field 8G. W77-12669

METALLURGICAL DEVELOPMENTS AID BITS, TOOL JOINTS, Hughes Tool Co., Houston, Tex. For primary bibliographic entry see Field 8G. W77-12670

CHOOSING THE RIGHT CABLE FOR THE RIGHT JOB, Ground Water Age, Vol. 11, No. 12, p 46-48, August, 1977. 6 tab.

Descriptors: *Pumps, *Electric motors, *Electric cables, Electric wires, Size. Identifiers: Submersible pumps, Three phase motors.

At a recent meeting of the Water Systems Council, the full technical committee approved a revised cable selection chart. The chart includes cable reactance, motor power factor, wire temperature rise, and capacity for 125 percent of maximum motor running amps. Changes from the chart issued about a year ago include clarification of the instructions, revision of the 208V table to 220V to agree with the NEMA standard on motor nameplate marking, and a shortened version of the larger wires in cable lengths. These charts are applicable to single phase (capacitor start) and three phase submersible motors only. Charts are based on maximum motor running current draw with a 5 percent voltage drop from the service entrance to the motor terminals. (Eberle-NWVA) W77-12671

EFFECTS OF DRILLING MUD ON ROCK BIT PERFORMANCE, Dresser Industries, Inc., Houston, Tex. For primary bibliographic entry see Field 8G. W77-12672

WATER WELL JOURNAL FUNDS HEAT PUMP RESEARCH.

Water Well Journal, Vol 31, No 8, p 45, August, 1977.

Descriptors: *Energy, *Groundwater, *Heating, Heat exchangers. Identifiers: *Groundwater heat pumps.

The Board of Directors of the Water Well Journal Publishing Company has recently approved funding for a five-year heat pump research study. Economic and energy savings engendered by a groundwater-to-air heat pump system in a single-family dwelling will be under investigation. The test facility will be an actual 1900 sq. ft. home (now under construction in the Columbus, Ohio area) housing a family of four; a control home of 1900 sq. ft., also housing a family of four and heated by conventional means, exists less than a mile away. Funds being made available will cover the costs of the heat pump unit, a recharge reservoir, and test instrumentation. A list of manufacturers of groundwater-to-air heat pump systems is given at the conclusion of this article. (Eberle-NWVA) W77-12676

NEW TECHNOLOGY: NEW ECCENTRIC DRILL BIT.

For primary bibliographic entry see Field 8G. W77-12677

CLAMSHELL-TYPE HYDRAULIC FLOW CONTROL GATE.

Bureau of Reclamation, Denver, Colo. Engineering and Research Center. T. J. Isbester.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 396. Price codes: A02 in paper copy, A01 in microfiche. Department of Interior Patent Disclosure, Serial No. 594, 824, July 10, 1975. 23 p, 9 fig. Issued by the Assistant Solicitor for Patents.

Descriptors: *Patents, *Gates, *Hydraulic gates, *Gate control, Equipment, Hydraulic equipment, High pressure gates, Hydraulics, Mechanical equipment, Hydraulic machinery, Flow, Flow control, Hydraulic systems. Identifiers: *Clamshell-type gates.

An apparatus for controlling fluid discharge through an outlet of a conduit comprises a clamshell-type gate including first and second opposed gate members pivotally mounted to the exterior of the conduit. The gate members are oppositely rotatable through an arc of approximately 90 deg between an open position and a closed position just downstream of the outlet. In the closed position, the gate members are closed together along a lip seal at the center of the conduit. A collar seal, mounted to the conduit, is urged against the gate members to block peripheral fluid discharge from the outlet. When the gate is fully or partially open, a portion of the outlet extends downstream of the lip seal to minimize 'fan out' of the discharge. In the fully open position, the gate members are open symmetrically beyond the diameter of the outlet for unrestricted fluid discharge through the outlet. The gate members are pivotally attached to trunnion members at each side of the conduit through support arm plates. In one embodiment, the support arm plates contain elongated slots approximately perpendicular to the gate members that act as cam surfaces for controlling rotation of the gate members. Rotation of the gate members is caused by longitudinal movement of control shafts, guided by the trunnion members. The shafts are connected to follower pins that ride the elongated slots in the support arm plates to provide the camming action. This arrangement produces a closing torque that progressively increases during closure of the gate members. (Sims-ISWS) W77-12817

8D. Soil Mechanics

TETON DAM FAILURE.

Civil Engineering-American Society of Civil Engineers, Vol 47, No 8, p 56-61, August 1977. 6 fig.

Descriptors: *Dam failure, *Dams, *Earth dams, *Idaho, Dam foundations, Dam construction, Dam design, Seepage, Soil mechanics, Rocks, Erosion, Grouting, Cement grouting, Grout curtains, Settlement(Structural), Fractures(Geologic), Fracture permeability, Disasters, Floods, Civil engineering. Identifiers: *Teton Dam(Idaho), *Piping(Earth dams).

In June 1976, Teton Dam in Idaho failed. It was an earthfill dam 305 ft high. The dam failed by piping through the impermeable core of the dam. Among factors believed contributing to failure were: pipeable silt soils used in the impermeable core of the dam; and foundation rock in the right abutment (where failure occurred) so highly fractured that hydraulically the rock was a permeable aquifer. Cause of failure may have been one or more of three factors: erosion of core material leading to an open channel through the keytrench bottom, hydraulic fracture, or differential settlement. Findings and conclusions by an independent panel and a federal government panel of dam specialists were summarized. (Sims-ISWS) W77-12324

THE WORLD'S HIGHEST DAMS, LARGEST EARTH AND ROCK DAMS, GREATEST MAN-MADE LAKES, LARGEST HYDROELECTRIC PLANTS, MAJOR DAMS, Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 8A. W77-12327

PROTECTION OF SLOPES AGAINST RAINFALL EROSION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. For primary bibliographic entry see Field 4D. W77-12561

LAND SUBSIDENCE AND CRACKING DUE TO GROUND-WATER DEPLETION, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 2F. W77-12803

OPPORTUNITIES FOR IMPROVEMENT IN THE DEVELOPMENT AND EVALUATION OF DESIGN ALTERNATIVES FOR FEDERAL WATER RESOURCES PROJECTS (REPORT TO THE CONGRESS), Comptroller General of the United States, Washington, D.C. Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 280. Price codes: A04 in paper copy, A01 in microfiche. April 1971. 74 p, 4 append.

Descriptors: *Water resources development, *Comparative costs, *Structural engineering, *Arch dams, *Rockfill dams, Construction costs, Water resources, Resources development, Water supply development, Research and development, Program, Project planning, Cost analysis, Estimated costs, Dams, Structures, Engineering, Canals, Conduits, Administrative agencies. Identifiers: *Embankment dams.

In 1971, both the Bureau of Reclamation of the Department of the Interior and the Corps of Engineers of the Department of the Army were operating water resources projects. The General Accounting Office (GAO) undertook a review of the projects to determine if the design practices of

Field 8—ENGINEERING WORKS

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both agencies were appropriate, and whether there was adequate coordination and dissemination of information between the agencies. The GAO found that some design practices of each agency were apparently not considered by the other and that substantial savings in project costs could be realized through the improvement of communication between the agencies. In one instance a saving of \$9 million would have resulted if the Corps had utilized an arch dam design favored by the Bureau of Reclamation instead of a rock-fill dam, according to the GAO; the Bureau could have saved \$100,000 for every embankment dam it constructed had it used the conduit design developed by the Corps. The report recommends that the Secretaries of both departments review the coordination and exchange of information between the agencies and adopt procedures which make the most efficient use of their joint capabilities. (Sloan-Florida)
W77-12898

8E. Rock Mechanics and Geology

TETON DAM FAILURE.

For primary bibliographic entry see Field 8D.
W77-12324

RECOVERY OF ENERGY FROM FRACTURE-STIMULATED GEOTHERMAL RESERVOIRS, Stanford Univ., Calif.

A. Hunsbedt, P. Kruger, and A. L. London. Journal of Petroleum Technology, Vol 29, No 8, p 940-946, August, 1977. 4 fig, 5 tab, 16 ref.

Descriptors: *Geothermal studies, *Energy transfer, *Rock properties, *Laboratory tests, Heat transfer, Thermal power, Thermal gradient, Fractures(Geology), Steam, Pressure.
Identifiers: *Hot dry rock, Hydraulic fracturing, Rock-energy extraction.

Neither vapor- nor liquid-dominated hydrothermal reservoirs are believed to be nearly as abundant as are hot rock systems that do not spontaneously produce steam or hot water due to lack of permeability, porosity, and fluid storage. Various fracture stimulation techniques have been proposed to make possible the use of artificial fluid circulation systems for extracting energy from such hot, igneous rocks. The laboratory studies described in this paper were designed to explore (1) conditions for optimum energy extraction (2) rock heat-transfer characteristics, (3) moving flash fronts (4) fluid-withdrawal reservoir pressure behavior (5) effects of hot and cool fluid recharge and (6) cyclic production/recharge operation of fracture-stimulated systems. Results showed that thermal energy stored in fracture-stimulated rock can be effectively extracted by lowering system pressure to initiate boiling within the rock matrix, the efficiency of such an operation depending upon characteristics of the recharge system, natural circulation in the liquid zone, mean rock size in the fractured area, and various other factors. (Eberle-NWWA)
W77-12680

HOT DRY ROCK: WIDESPREAD BUT INVISIBLE.

Los Alamos Scientific Lab., N. Mex.
F. G. West, and T. J. Shankland.
EOS Transactions, American Geophysical Union, Vol 58, No 5, p 299-302, May, 1977. 1 fig.

Descriptors: *Geothermal studies, *Rock properties, *Subsurface investigations, Temperature, Geophysics, Heat flow, Energy, Thermal power.
Identifiers: *Hot dry rock.

Exploration for hot dry rock (HDR) as a potential geothermal resource presents some novel problems not encountered in exploration for other geological resources. Participants at a June, 1976

meeting at Los Alamos Scientific Laboratory concluded that a variety of techniques must be utilized in order to assess HDR regions. Because rock suitable for HDR geothermal energy production technologies has relatively few geological manifestations and is almost geophysically invisible on a local scale, related manifestations and patterns must be sought more than hot dry rock itself. Various combinations of geological, seismic, electromagnetic, gravity, and heat flow technologies will need to be employed over both large and localized areas in order to pinpoint potentially good sites for HDR energy production. Not only must the rock have a temperature between 200 and 400 degrees C, it must also have very low permeability to prevent the escape of the fluids injected downhole meant for the production and retrieval of steam. (Eberle-NWWA)
W77-12681

8F. Concrete

TETON DAM FAILURE.

For primary bibliographic entry see Field 8D.
W77-12324

HEAVY RAINS, POOR SOIL FORCE INTERNAL SEWER REPAIR.

Engineering News Record, Vol. 199, No. 8, p 20, August, 1977.

Descriptors: *Sewers, *Infiltration, *Grout curtains, *Cement grouting, *Combined sewers, Interceptor sewers, Sewerage, Construction costs, Repairing, Pipes, Concrete pipes, Rehabilitation, Waste water treatment.
Identifiers: Wilkes-Barre(PA).

A \$1 million sewer repair project directed by Smith, Miller Associates (SMA) of Kingston, Pennsylvania was financed by the Federal Disaster Assistance Administration after tropical storm Eloise caused a rupture in an 800-ft-long combined sewer near Wilkes-Barre, Pennsylvania in 1975. The sewer transports 3.5-4.0 mgd of sanitary sewage from southern Wilkes-Barre to the Wyoming Valley Pumping Station and eventually to the Horton treatment plant. For an investigation of the damage to the sewer line, sewage was re-routed from the 42-inch Barney Farm sewer line through 10-inch pipes running parallel to the interceptor. After dewatering and cleaning of the sewer line, the interceptor ruptured again. A steel and concrete casing was placed around the sewer line at the site of the initial rupture and cleaning began again. Heavy rains again produced infiltration and ruptures during the fall of 1976. SMA then began using a high-velocity vacuum system to clean the sewer pipe. External grouting had to be used to stop excessive infiltration until the waters of the Susquehanna River receded enough to begin internal reinforcement of the sewer by spray application of concrete. Where infiltration could not be controlled by internal spraying, grout was pumped to the outer surface of the pipe through 1.5-inch plastic pipes. Repeated rainfall, unstable soil conditions, and high water levels resulted in a final cost for the 20-month project of \$972,000. (Schulz-FIRL)
W77-12459

WATER QUALITY, CONDUITS, AND GEOMETRICS.

National Research Council, Washington, D.C. Transportation Research Board.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 101, Price codes: A04 in paper copy, A01 in microfiche. Transportation Research Record 556, 1975. 41 fig, 9 tab, 28 ref, 1 append. (ed. Silberman, J.).

Descriptors: *Conduits, *Storm water, *Highways, *Concrete pipes, *Sewers, Structural analysis, Structural engineering, Urban runoff, Water quality, Data collections, Cities.

Identifiers: Transportation Research Board.

Articles dealing with urban runoff and storm water conduits were prepared for the 54th annual meeting of the Transportation Research Board. A testing program in Milwaukee, Wisconsin, for quality of storm water runoff from urban freeways is described. The use of composite construction of conduits for sewer systems is investigated. Failure analyses for an unreinforced concrete conduit are presented. A method of curve design to be used in highway construction is also described. (See W77-12500 thru W77-12502) (Schulz-FIRL)
W77-12499

COMPOSITE CONDUIT CONSTRUCTION FOR LOWER COST INSTALLATIONS AND IMPROVED PERFORMANCE.

T. K. Breitfuss.

In: Water Quality, Conduits, and Geometrics. Transportation Research Record 556, 1975. p 6-19, 19 fig, 2 tab, 8 ref.

Descriptors: *Conduits, *Concrete pipes, *Structural engineering, *Stress analysis, *Strength of materials, Shear strength, Pipes, Engineering structures, Sewers, Model studies.
Identifiers: Composite conduits.

The use of conduits having a thin-shelled core surrounded by a supporting medium such as concrete or a combination of concrete and soil-cement are discussed. Prior to studies on composite construction, shear transfer capacities were examined for various bonding agents. Comparative analyses for eight composite configurations having different modes and degrees of encasement with soil-cement, dense sand, and concrete were based on calculations of moment, thrust, shear, and earth load. The allowable load and design criteria for open-topped conduits, soil-cement or unbonded concrete as a surrounding medium, and full encasement with bonded concrete were discussed. Field tests showed that thin-cored composite conduits would greatly limit vertical deflections for backfill of almost any height. (See also W77-12499) (Schulz-FIRL)
W77-12501

FAILURE OF A CAST-IN-PLACE UNREINFORCED CONCRETE CONDUIT.

California State Dept. of Transportation, Sacramento. Div. of Construction and Research.
J. C. Chang.

In: Water Quality, Conduits, and Geometrics. Transportation Research Record 556, 1975. p 25-34, 12 fig, 5 tab, 5 ref.

Descriptors: *Conduits, *Structural analysis, *Structural engineering, *Failures, *Stress analysis, *Concrete pipes, Strength of materials, Pipes, Sewers, Concrete testing, Overburden, Soils, Shear stress.
Identifiers: San Dimas(CA).

A structural analysis of the failure of a 72-inch cast-in-place, unreinforced concrete conduit at the toe of a highway embankment near San Dimas, California is presented. Soil analyses of backfill were used to determine soil shear strength by triaxial compression tests. Earth pressures on the conduit due to local overburden and highway embankment load were calculated. The distribution of internal hydrostatic pressure on the waste-filled conduit was examined. Analyses of moment, thrust, and shear due to internal and external loads were performed. Results indicated that failure was due to the additional lateral load from the highway embankment which caused the upper half of the conduit to be sheared off. The conduit was subsequently replaced with a class 4, double-caged, reinforced pipe. (See also W77-12499) (Schulz-FIRL)
W77-12502

BURIED WELL SEALS: A NEW METHOD OF RECONSTRUCTION.

Environmental Protection Agency, Washington, D.C. Div. of Water Supply.
For primary bibliographic entry see Field 5G.
W77-12665

8G. Materials**CONVEYOR SYSTEM MOVES SEWAGE QUICKLY, PREVENTS SPILLAGE.**

Water and Sewage Works, Vol. 124, No. 8, p 47-48, August, 1977.

Descriptors: *Conveyance structures, Equipment, *Sludge treatment, *Sludge disposal, *Dewatering, Treatment facilities, Sewage disposal, Sewage treatment, Waste water treatment.

Identifiers: Conveyor belts, East Windsor Township(NJ).

A belt conveyor system manufactured by the Bucket Elevator Company is being used at a sewage treatment facility in East Windsor Township, New Jersey, to move sewage, grit, and other solid and semi-solid waste products quickly and without spillage. Belting with corrugated siding is used to remove wastes from filters, screening devices, and centrifuges. The Corra-Trough conveyor meets the system's requirements of flexibility for maximum use of limited floor space and adjustability for accommodation of several sizes of trucks. Sludge dewatering at the East Windsor plant is accomplished by a Permutit DCG dewatering device, and a multi-roll press. A combination of four 12-inch wide conveyors, three portable and one stationary with adjustable discharge height and cleats, transports sludge between the dewatering device and multi-roll press. Conveyors also deposit material on an inclined conveyor for final disposal into a truck. Response to the system's maneuverability and maintenance was favorable. (Schulz-FIRL)
W77-12447

DUCTILE IRON PIPES TO CARRY WIMBLEBALL WATER.

Water Services, Vol. 81, No. 976, p 368, June, 1977.

Descriptors: *Metal pipes, *Joints(Connections), *Reservoir construction, *Water treatment, Reservoirs, Pipelines, Pipes, Waste water treatment.

Identifiers: *Ductile iron pipes, *Wessex Water Authority(UK), Tyton joints, Stantyte joints.

The Stanton and Stavely Group of British Steel Corporation's Tubes division is furnishing 4500 tons of ductile spun iron pipes to the Wessex Water Authority for the construction of trunk mains to the Wimbleball Reservoir. Pipe supplied includes 15,683 m of pipe in the 600 mm to 250 mm diameter range fitted with Tyton joints, and 13,789 m of 700 mm diameter pipe fitted with Stantyte joints. Construction of Wimbleball Reservoir is scheduled for completion by the end of 1977. The completed reservoir will service the Wessex and South West Water Authorities. (Schulz-FIRL)
W77-12464

HANDBOOK FOR SEWER SYSTEM EVALUATION AND REHABILITATION.

Environmental Protection Agency, Washington, D.C. Office of Water Program Operations.
For primary bibliographic entry see Field 5D.
W77-12479

FAILURE OF A CAST-IN-PLACE UNREINFORCED CONCRETE CONDUIT.

California State Dept. of Transportation, Sacramento, Div. of Construction and Research.
For primary bibliographic entry see Field 8F.

W77-12502

TIME SCALE AND MOLECULAR WEIGHT DISTRIBUTION CONTRIBUTIONS TO DILUTE POLYMER SOLUTION FLUID MECHANICS.

Pennsylvania State Univ., University Park. Applied Research Lab.
For primary bibliographic entry see Field 8B.
W77-12564

BEACH FILL STABILITY AND BORROW MATERIAL TEXTURE.

Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2J.
W77-12566

BURIED WELL SEALS: A NEW METHOD OF RECONSTRUCTION.

Environmental Protection Agency, Washington, D.C. Div. of Water Supply.
For primary bibliographic entry see Field 5G.
W77-12665

DRILLING RESEARCH TO PAY OFF BY 2000.

Maurer Engineering Inc., Houston, Tex.
For primary bibliographic entry see Field 8C.
W77-12668

INGENUITY SPARKS DRILLING HISTORY.

Petroleum Publishing Co., Tulsa, Okla.
W. D. Moore, III.
Oil and Gas Journal, Vol. 75, No. 35, p 159-177, August, 1977. 12 fig, 6 tab, 2 ref.

Descriptors: *Drilling, *Drilling equipment, *Rotary drilling, History, Water wells, Oil wells, Deep wells.
Identifiers: *Cable tool drilling, Spring-pole drilling.

Both the Egyptians and the Chinese drilled numerous wells more than 2000 years ago, but it was the Chinese who made the earliest progress in deep well operations. By the year 1200, Chinese drillers had completed 1500 ft. wells and were keeping detailed logs. Most early wells, even the deep ones, were drilled with a spring-pole apparatus. Steam power was added to spring-pole devices in the mid-19th century. The famous Drake oil well of 1859 was the earliest popularized successful well put down by cable tool methods, and sparked a cable tool drilling boom that lasted nearly 100 years. Development of rotary drilling methods came about fairly slowly. Isolated European well projects in the early 1800's made use of hand-powered rotary drills, with the steam-powered rig coming into its own at the turn of the century. Rotary and cable tool equipment then worked side by side in well fields until the rotary machines came to dominate the oil industry almost completely during the last decade. (Eberle-NWWA)
W77-12669

METALLURGICAL DEVELOPMENTS AID BITS, TOOL JOINTS.

Hughes Tool Co., Houston, Tex.
H. C. Dill, and S. R. Scales.
Oil and Gas Journal, Vol. 75, No. 36, p 62-66, August 29, 1977. 16 fig.

Descriptors: *Metallurgy, *Drilling equipment, *Rotary drilling, Steel pipes, Joints(Connections), Welded joints, Bearings.
Identifiers: *Journal bearing bits, *Tool joints, Boronizing, Drill pipe.

When journal-bearing 'Hugheset' bits were introduced to the drilling industry, the cones were inlaid with a soft, anti-galling silver alloy in the grooves and holes, while the bearing pins were

hard-faced with a cobalt-based, wear resistant alloy. Both these treatment operations were performed using a manual oxyacetylene torch, and proved to be very time consuming. It was recently discovered that automated gas-tungsten-arc-welding is feasible for cone inlay work, and that cobalt alloy hard-facing could be replaced by carburizing and boronizing journal bearing pin surfaces. Experimentation with tool joints over the past few years has focused on improving welding processes. Interest in high-strength drill pipe also spread through the industry during approximately the same period, with a great deal of reasearch having been done in tempering and heat treating. In addition to providing considerable detail on the technical aspects of these tool developments, relevant materials testing procedures are briefly discussed in this article (Eberle-NWWA).
W77-12670

EFFECTS OF DRILLING MUD ON ROCK BIT PERFORMANCE.

Dresser Industries, Inc., Houston, Tex.
K. Greene, and E. Moerbe.
Drilling-DCW, Vol. 38, No. 12, p D2-D4, September, 1977. 4 fig, 2 tab, 5 ref.

Descriptors: *Drilling fluids, *Additives, *Rotary drilling, Mud, Drilling equipment, Density, Viscosity.
Identifiers: *Bits, Rate of penetration.

The physical properties of drilling fluids affect a drill bit's penetration rate and overall performance. It has been proved in the field that the best drilling medium, other than gas and air, is solids-free water. In many cases, however, a hole has to be mudded up because using water would be either impractical or impossible. As solids are incorporated into a system, fluid properties change. Density and viscosity increase, which tend to reduce the rate of penetration of the bit. While fluid loss in and of itself has no effect on penetration rate, additives used to combat fluid loss also increase the viscosity of the mud, thus slowing the drilling process. The proper use of certain specialty items, detergents for example, can maximize drilling efficiency by keeping the bit from balling. Overall, the answer to satisfactory performance lies in the ability to integrate solids control equipment, drilling mud, the bit, and the hydraulics program to allow drilling to proceed effectively, quickly, and safely. (Eberle-NWWA)
W77-12672

WELL REDEVELOPMENT: PART 1.

National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 8B.
W77-12673

DIGITAL MONITORS FOR OHIO'S WELLS.

For primary bibliographic entry see Field 4B.
W77-12675

NEW TECHNOLOGY: NEW ECCENTRIC DRILL BIT.

Water Well Journal, Vol 31, No 8, p 47-48, August, 1977, 2 fig.

Descriptors: *Rotary drilling, *Drilling equipment, *Overburden, Wells.
Identifiers: *ODEX eccentric drill bit.

Joint development work by Sandvik and Atlas Copco has resulted in a new method of overburden drilling known as the Odex method, built around a new eccentric drill bit. According to Atlas Copco officials, it is possible to drill through all types of soils, including those with a high content of boulders, with the Odex equipment; thus, the economic advantages of drilling through to bedrock (rather than excavating first) can be exploited. Standard equipment for the Odex method

Field 8—ENGINEERING WORKS

Group 8G—Materials

consists of three parts; a guide, a reamer, and a pilot bit. The reamer bit swings into its eccentric working position when drilling begins, making a hole large enough for casing to follow immediately behind. Cuttings can be flushed from the bit area using either air, water, or a foaming mixture. Odecc eccentric equipment is available for 3-inch or 5-inch diameter bits, and also for a 4 1/2-inch downhole hammer bit. (Eberle-NWWA)
W77-12677

PUMPING TESTS PROVIDE USEFUL DATA:
PART 3,
Universal Oil Products, St. Paul, Minn. Johnson Div.
S. J. Forrest.
Johnson Drillers Journal, Vol 49, No 4, p 5-7, July-August, 1977. 3 fig, 1 tab.

Descriptors: *Water wells, *Drawdown, *Pumping, Observation wells, Specific capacity, Transmissivity, Storage coefficient.
Identifiers: *Pumping tests, *Cone of depression, Well interference.

The plot of drawdown values at a known distance from a well pumping at a constant discharge shows an instantaneous image of the cone of depression around that well. From such observations, predictions can be made about well efficiency and the interference between intersecting cones of depression. Spacing of observation wells should, when possible, anticipate the difference in drawdown effects between water table and artesian aquifers. Data from these observation wells will form a linear graph when plotted on semi-log paper, time and pumping rate being constant. By extending this line backward to within the well diameter, theoretical drawdown can be determined, then compared with actual drawdown to calculate well efficiency. After all readings have been taken, the formation's storage coefficient and transmissivity can be computed, as well as distance-drawdown curves for different pumping rates. The relationship between distance-drawdown on a log scale and pumping rate can also be exploited to predict interference between multiple wells and to find the pumping rate at which any given well will have the least effect on the one adjacent. (Eberle-NWWA)
W77-12683

USE OF THE EXPERIMENTAL WATER STABILIZATION STATION AT THE NOVOMYLS'K WATER INTAKE IN ROVNO, (IN RUSSIAN),
Regional Sanitary-Epidemiological Center, Rovno.
V. E. Zelyulin, A. G. Gudakov, P. I. Batrak, and M. L. Klimenko.
Gig Sanit. 10, p 91-92, 1974.

Descriptors: *Corrosion control, *Organoleptic properties, Iron, Lime, Acids, Intakes, Water treatment.
Identifiers: Ukrainian-SSR, *USSR(Rovno).

The use of water stabilization at the Novomyly'skii water intake located 16.8 km from Rovno (Ukrainian SSR) made it possible to stop corrosion of the inside walls of the water line and improve the physicochemical and organoleptic properties of the water being delivered to the population by binding the corrosive carbonic acid with lime with corresponding decrease of the Fe content by 8-10 times.—Copyright 1975, Biological Abstracts, Inc.
W77-12893

8I. Fisheries Engineering

IMPROVED BYPASS AND COLLECTION SYSTEM FOR PROTECTION OF JUVENILE SALMON AND STEELHEAD TROUT AT LOWER GRANITE DAM,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
G. M. Matthews, G. A. Swan, and J. R. Smith.

Marine Fisheries Review, Vol. 39, No. 7, p. 10-14, 1977. 6 fig, 3 ref.

Descriptors: *Design, Research and Development, *Dams, *Bypass, *Fish passages, Transportation, Design flow, Design standards, Fish migration, Life cycles, Salmonids, Juvenile growth stage, Trout, Salmon, Technology, Columbia River.
Identifiers: *Lower Granite Dam, *Collection system, Snake River.

A new and improved system for diverting, bypassing, and collecting juvenile salmon, *Oncorhynchus* sp., and steelhead trout, *Salmo gairdneri*, at Lower Granite Dam on the lower Snake River was described. Major changes from previous systems of this type included a special fish screen slot for placement of the improved traveling screen, an open gallery bypass system for routing fish around the turbines, and a collection and holding area totally supplied by gravity-flow. (Katz)
W77-12276

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

UNITED STATES GEOLOGICAL SURVEY ANNUAL REPORT, FISCAL YEAR 1976.
Geological Survey, Reston, Va.
Available from Branch of Distribution, USGS, 1200 S Eads St., Arlington, VA, 22202, price \$3.60. Annual Report, 1976. 212 p.

Descriptors: Reviews, *Projects, *Data collections, *Annual, *Publications, Water resources, Surface waters, Streamflow, Groundwater, Aquifer characteristics, Water yield, Water quality, Land development, Mining, Leases, Data processing, Computer programs, Libraries, Information retrieval, Maps.
Identifiers: *US Geological Survey.

Statistics for the U.S. Geological Survey for fiscal year 1976 indicate that 10,000 maps of all types were produced, that 3,400 reports were approved for publication, and that 158,000 water-quality analyses were made. Additional ground- and surface-water measurements were made at 33,820 stations throughout the United States. The Geological Survey also supervised 2,557 leases on the public lands covering 3.7 million hectares (9.1 million acres) and collected \$950,000,000 in royalties and rentals. During fiscal year 1976 and the transition quarter, the library acquired 142,000 new publications. In addition, more than 407,000 photographs and digital tapes were ordered from the EROD Data Center, and 398,965 inquiries for data and information were handled by the Pacific Inquiries Offices. (Woodard-USGS)
W77-12369

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-12372

10C. Secondary Publication And Distribution

UNITED STATES GEOLOGICAL SURVEY ANNUAL REPORT, FISCAL YEAR 1976.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 9D.
W77-12369

ACID MINE DRAINAGE, A BIBLIOGRAPHY WITH ABSTRACTS.
National Technical Information Service, Springfield, Va.
For primary bibliographic entry see Field 05G.
W77-12664

TASTES AND ODORS IN WATER SUPPLIES-A REVIEW,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 05F.
W77-12794

GLACIOLOGICAL DATA, THIS ISSUE: AVALANCHES.
World Data Center A for Glaciology, Boulder, Colo.
For primary bibliographic entry see Field 02C.
W77-12799

REVIEW PAPER: THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS AND CORRESPONDING MEASUREMENT PROCEDURES,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 05C.
W77-12865

MINIMAL DISSOLVED OXYGEN REQUIREMENTS OF AQUATIC LIFE WITH EMPHASIS ON CANADIAN SPECIES: A REVIEW,
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
For primary bibliographic entry see Field 05C.
W77-12871

CRITERIA DOCUMENT FOR PCB'S,
Massachusetts Audubon Society, Lincoln.
For primary bibliographic entry see Field 05A.
W77-12882

10F. Preparation Of Reviews

STATUS OF SEA WATER REVERSE OSMOSIS MEMBRANE PROCESS TECHNOLOGY,
Office of Water Research and Technology, Washington, D. C.
For primary bibliographic entry see Field 03A.
W77-12571

NONPOINT SOURCES: STATE-OF-THE-ART OVERVIEW,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05G.
W77-12614

HISTORY, STATUS AND FUTURE OF DISTILLATION PROCESSES,
Watson Desalination Consultants, Manassas, Va.
For primary bibliographic entry see Field 03A.
W77-12631

STATE-OF-THE-ART OF MEMBRANE AND ION EXCHANGE DESALTING PROCESSES,
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 03A.

W77-12632

TASTES AND ODORS IN WATER SUPPLIES-A REVIEW,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 05F.
W77-12794

REVIEW PAPER: THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS AND CORRESPONDING MEASUREMENT PROCEDURES,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 05C.
W77-12865

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- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports October-December 1976. Volume 1: Receptors (Biota): Marine Mammals; Marine Birds; Microbiology. W77-12964 6G
- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports October-December 1976. Volume 2: Receptors (Biota): Fish; Plankton; Benthos; Littoral. W77-12965 6G
- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports October-December 1976. Volume 4: Hazards; Data Management. W77-12966 6G

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- Ground and surface water hydrology at the Illinois State Water Survey.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

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A22.....15.25		
A23.....15.50	N01.....28.00	
A24.....16.25	N02.....50.00	
A25.....16.50		
A99.....*		

*Contact NTIS for price quote

PRICES EFFECTIVE OCT. 1, 1977 THRU MAR. 31, 1978

